TEST REPORT

UL 2743 & UL 1450

UL Standard for Safety for Portable Power Packs& Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment

Job Number. ..... :	XK2109012126S
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Checked by (print+signature)..... :	Jean Shu
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Date of issue ..... :	September 18, 2021
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Manufacturer's name..... :	**Dongguan Hezong Electronic Technology Co., Ltd.**
Address..... :	Room 309, Building 1, No. 2, Hongye North 1st Road, Tangxia Dongguan city Guangdong Province China 523000
Test specification:	
Standard ..... :	UL 2743 Second Edition, issued Dated July 3, 2018, Re: April 30, 2020 UL 1450, Fourth Edition, Dated May 5, 2010, Re: May 27, 2021
Test procedure..... :	Type test
Non-standard test method..... :	N/A
Test Report Form No. ..... :	UL 2743&1450_2021
Test Report Form(s) Originator.... :	SiCT
Master TRF ..... :	Dated 2021-07
Test item description..... :	Jump Starter & Air Pump
Trade Mark..... :	N/A
Model/Type reference..... :	HZ009, HZ014
Ratings..... :	Input: DC5V-2A USB Output: DC5V/2A, Battery capacity: 10400mAh

Test item particulars ..... :	
Equipment mobility ..... :	☒ movable ☐ hand-held ☐ stationary ☐ fixed
Connection to the mains ..... :	☐ pluggable equipment ☐ direct plug-in ☐ permanent connection ☐ for building-in ☒ N/A
Operating condition ..... :	☒ continuous ☐ short-time ☐ intermittent
Overvoltage category ..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Class of equipment ..... :	☐ Class I ☐ Class II ☒ Class III ☐ Not classified
Mass of equipment (kg) ..... :	

Possible test case verdicts:	
- test case does not apply to the test object ..... :	N (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 ..... :	September 13, 2021
Date(s) of performance of tests ..... :	September 13, 2021 to September 18, 2021

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.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

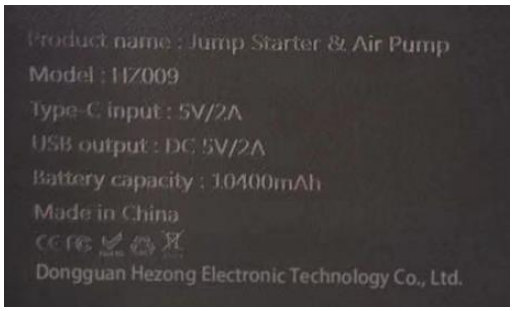
General product information:

The product covered by this report is Jump Starter & Air Pump intended for use as Portable Power Packs. The product is equipped with one 10400mAh battery pack which comply with UL 2054.

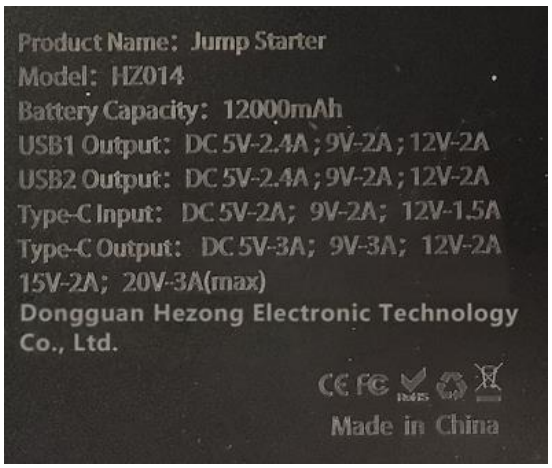
All the test were performed on model HZ009. And found to comply with the standard was subjected to all the tests. All models are identical except the model name and appearance.

Copy of marking plate:

Note 1: The making will be silk-screen printed or stamped on the product.



Marking label for model HZ009



Marking label for model HZ014

UL 2743			
Clause	Requirement + Test	Result - Remark	Verdict
1	Scope		P
2	Units of Measurement		P
3	Components		P
4	Undated References		P
5	Glossary		P
Construction			--
6	General		P
6.1	If the operation and maintenance of a power pack by the user involves a risk of injury to persons, a risk of electric shock, or a risk of fire, means shall be provided to reduce the risk. When evaluating a power pack, consideration shall be given to reasonably foreseeable misuse of the product.		P
6.2	Power packs intended for use within a repair facility, and marked as such as indicated in 69.4, shall be provided with instructions containing the statement in 74.3 and shall be marked as shown in 70.19. Power packs that are not intended for use in a repair facility shall be marked in accordance with 70.20.		N/A
6.3	Outdoor use power packs shall be evaluated for all environmental considerations addressed by this standard and are intended to be used and stored either outdoors or indoors. Temporary outdoor use power packs shall be evaluated for exposure to rain, shall be marked in accordance with 70.20 and 70.21, and shall be provided with instructions in accordance with 74.5. Indoor use only power packs shall be marked in accordance with 70.22 and shall be provided with instructions in accordance with 74.6. Indoor use only packs need not comply with the environmental considerations in 7.5.		P
6.4	For power packs not marked in accordance with 70.23, the device shall be subjected to the Vibration Test, Section 51.		P
7	Frame and Enclosure		P
7.1	General		P
7.2	Metallic enclosures		N/A
7.3	Nonmetallic enclosures		P
	Conductive coating		P
7.4	Openings in enclosures		N/A
7.5	Environmental considerations		P
8	Flammability of Materials		P

UL 2743			
Clause	Requirement + Test	Result - Remark	Verdict
9	Assembly		N/A
10	Corrosion Protection		P
11	Supply Connections		P
11.1	General		P
11.2	Flexible cord connection		N/A
11.2.2	Strain relief		N/A
11.2.3	Bushings		N/A
11.3	External power supplies		P
11.4	Vehicle adapters		N/A
11.5	Photovoltaic panels		N/A
12	Output Connections		P
12.1	General		P
12.2	Booster cable assemblies		N/A
12.2.1	General		N/A
12.2.2	Cables		N/A
12.2.3	Clamps		N/A
12.3	Receptacles		N/A
12.4	DC output connectors and USB connectors		P
12.5	Vehicle adapter sockets		N/A
13	Grounding		N/A
13.1	General		N/A
13.2	Grounding identification		N/A
14	Double Insulated Products		N/A
15	Current Carrying Parts		P
16	Internal Wiring		P
16.1	Mechanical protection		P
16.2	Wiring insulation		P
16.3	Splices and connections		P
17	Separation of Circuits		N/A
18	Insulating Materials		N/A
19	Compressors		N/A
19.1	General		N/A
19.2	Motors and thermal protection		N/A
19.3	Parts subject to pressure		N/A

UL 2743			
Clause	Requirement + Test	Result - Remark	Verdict
19.3.1	A part of the power pack that is subject to pressure during normal or anticipated abnormal operation shall withstand, without rupture, a pressure corresponding to five times the maximum pressure that can be developed by the system.		N/A
19.3.2	In the event that a test is required to determine whether a part complies with the requirement in 19.3.1, two samples of the power pack are to be subjected to the Hydrostatic Strength Test, Section 59. Prior to the test, parts molded of polymeric material are to be conditioned in an air circulating oven for 7 hours at a temperature of 70°C (158°F) or 10°C (18°F) higher than the maximum temperature measured on the part under normal load, whichever is greater. The samples are to be removed from the oven and allowed to cool to room temperature prior to the test.		N/A
20	Capacitors and Electrochemical Capacitor Modules		N/A
20.1	Capacitors		N/A
20.2	Electrochemical capacitor modules		N/A
21	Resistors		N/A
22	Lampholders		N/A
23	Transformers		N/A
24	Switches and Controls		P
24.1	A switch or other control device shall be suitable for the application and shall have current and voltage ratings not less than those of the circuit that it controls when the power pack is operated as intended.		P
24.2	A primary circuit switch that controls an inductive load having a power factor less than 75 percent, such as a transformer, and that does not have an inductive rating, shall be rated not less than twice the full load current rating of the load, or the switch shall be investigated for this application.		N/A
24.3	A switch or other control device not having an inductive rating that is connected in a transformer secondary circuit shall comply with the Normal Temperature Test, Section 47, and with the Overload of switches and controls test, Section 53.2.		P

UL 2743			
Clause	Requirement + Test	Result - Remark	Verdict
24.4	Unless rated for the application, a switch or other device that controls a motor and is not interlocked so that it will not break the locked rotor motor current shall be subjected to the Overload of switches and controls test, Section 53.2, based on the locked rotor current of the motor.		N/A
24.5	A switch that controls a tungsten-filament lamp shall have a tungsten-filament lamp current rating not less than the maximum current it will control.		N/A
24.6	A switch shall not disconnect the grounded conductor of a circuit.		N/A
24.7	If unintentional operation of a switch results in a risk of injury to persons, the actuator of the switch shall be located or guarded so that such operation is unlikely. The actuator of a switch may be guarded by recessing, ribs, barriers, or the like.		N/A
25	Printed Wiring Boards		P
26	Interlocks		N/A
27	Overload Protection Devices		N/A
27.1	An overcurrent or thermal protective device shall be suitable for the application.		N/A
27.2	An automatic reset device used to comply with 27.1 shall be cycled through 200 operations. At the end of the 200 operations, the device shall be able to perform its intended function with no additional risk of fire, electric shock, or injury to persons. See Overload of protection devices, Section 53.3.		N/A
27.3	A fuse involving a risk of electric shock shall be inaccessible: a) To the user from outside the enclosure, and b) To the user during any user servicing.		N/A
27.4	A fuse that can be serviced by the user shall be secured in a fuseholder that is constructed and installed such that no uninsulated live parts will be accessible to contact by persons removing or replacing the fuse. The power pack shall be marked in accordance with 70.10. This marking shall be adjacent to the fuse.		N/A
27.5	The screw shell of a plug fuseholder and the accessible contact of an extractor type fuseholder shall be connected to the load.		N/A
28	Internal Battery		P
28.1	General		P
28.2	Lead acid batteries		N/A

UL 2743			
Clause	Requirement + Test	Result - Remark	Verdict
28.2.1	A lead acid battery shall comply with the requirements in the Standard for Standby Batteries, UL 1989.		N/A
28.2.2	The power pack shall provide a means of reverse polarity protection or the test of 50.3 shall be performed.		N/A
28.2.3	The power pack shall provide short circuit protection for the battery or the test of 50.2 shall be performed.		N/A
28.2.4	The power pack shall provide a means to prevent overcharge of the battery or the test of 50.9 shall be performed.		N/A
28.2.5	The battery shall be subjected to the Normal Operation Charging Test, Section 43.		P
28.3	Lithium-ion batteries		P
28.3.1	A lithium-ion battery cell shall comply with the requirements in the Standard for Lithium Batteries, UL 1642, or in the Standard for Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes – Safety Requirements for Portable Sealed Secondary Cells, and for Batteries Made From Them, for Use in Portable Applications, UL 62133.		P
28.3.2	The power pack shall provide a means of reverse polarity protection or the test of 50.3 shall be performed.		P
28.3.3	The power pack shall provide short circuit protection for the battery or the test of 50.2 shall be performed		P
28.3.4	The power pack shall provide a means to prevent overcharge of the battery or the test of 50.9 shall be performed.		P
28.3.5	The battery shall be subjected to the Normal Operation Charging Test, Section 43.		P
28.3.6	The power pack shall be subjected to the Lithium-Ion Charging System Test, Section 44.		P
29	Spacings		N/A
30	Inverters		P
30.1	Inverters provided as part of the power pack shall be shown to comply with the applicable requirements in this outline. See 30.2. Exception: Inverters that comply with the Standard for Power Units Other Than Class 2, UL 1012, comply without further evaluation.		P

UL 2743			
Clause	Requirement + Test	Result - Remark	Verdict
30.2	With reference to 30.1, specific attention should be given to: a) Printed Wiring Boards, Section 25; b) Spacings, Section 29; c) Normal Temperature Test, Section 47; d) Dielectric Voltage Withstand Test, Section 48; and e) Abnormal Operation Tests, Section 50.		P
31	Charging Functions		N/A
31.1	Specialized packs that provide a charging function while connected to the source of supply that is intended to charge the external battery through the pack's booster cable assembly, or other output connection, shall have the charging circuits evaluated in accordance with the applicable requirements in the Standard for Battery Chargers for Charging Engine-Starter Batteries, UL 1236.		N/A
Protection Against Injury To Persons			--
32	General		P
33	Back Feed Protection		P
34	Sharp Edges		P
35	Strength of Enclosure		P
36	Attachments		P
37	Stability		P
38	Strength of Handles		P
39	Surface Temperatures		P
40	Safety Circuits and Control Circuits		P

TABLE: List of critical components					**P**
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity
Internal wire	YUYAO DONGHAI SPECIAL WIRE FACTORY	1015	Min. 22AWG, Min. 80°C, VW-1, 300V	UL 758	UL E212811
Plastic enclosure	SABIC INNOVATIVE PLASTICS US L L C	945 (GG)	PC, V-0, 120°C, min. 1.8mm thickness	UL 94	UL E121562
Battery pack	EVE ENERGY CO LTD	ICR18650/26V	DC3.6V, 2550mAh	UL 1642	UL MH28717
PCB	QIAOLIAN ELECTRONICS (DONGGUAN) CO LTD	2V0	V-0, 130°C	UL 796	UL E314348
Battery pack	EP	853496#	14.8V, 10400mAh	UL 2054	UL
Supplementary information:					

29 Spacing N/A

Method:

29.1 Spacings between live parts of opposite polarity, and between live and dead metal parts shall not be less than specified in Table 29.1. If an uninsulated live part is not rigidly secured in position by means other than friction between surfaces, or if a movable dead metal part is in proximity to an uninsulated live part, the construction shall be such that at least the minimum spacings are maintained. See 29.2.

Results

29 Spacings												N/A
Transformer ( )						Max. frequency:						
Test condition or operation mode:												
Pri. pins / Sec. pins	Vrms	Vpeak	Vrms	Vpeak	Vrms	Vpeak	Vrms	Vpeak	Vrms	Vpeak	Vrms	Vpeak
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29 Spacings						N/A
clearance and creepage distance at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	Dcr (mm)
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29 Spacings				**N/A**
Distance through insulation di at/of:	U r.m.s. / Upeak	test voltage (V)	required di (mm)	Di (mm)
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Thin sheet material at/of:	U r.m.s. (V)	test voltage (V)	required layers	Layers
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42 Power Input Test

Method:

42.1 The current input to a power pack shall not exceed 110 percent of the marked current rating of the power pack, when the power pack is operated under the conditions of maximum normal load.

42.2 Maximum normal load shall consist of the maximum current draw while the power pack is operating in all possible modes. For example, this may include running an air compressor, while a light is on, and the internal battery is charging. Any load that can be operated at the same time shall be operated in order to obtain the maximum normal load.

Results:

42	TABLE: Power input test					P
U (V)	I (A)	Irated (A)	P (W)	Fuse #	Ifuse (A)	Condition/status
DC5V	1.65	2	8.25	--	--	Max. normal load (battery fully discharged)
Notes:						

43 Normal Charging Operation Test

Method:

1, Charging a lithium-ion battery under normal conditions shall not exceed the specified operating region for charging of the cell.

2, The battery is charged in accordance with the charging system instructions starting with a fully discharged battery. Testing is carried out at an ambient temperature of 20 ±5°C (68 ±9°F) and:

a) If the power pack is recommended to be operated at a minimum temperature lower than 4°C (39.2°F), the test is also conducted at that minimum temperature plus 0/minus 5 °C (plus 0/minus 9 °F); or

b) If the appliance is recommended to be operated at a maximum temperature greater than 40°C (104°F), the test is also conducted at that maximum temperature plus 5/minus 0 °C (plus 9/minus 0 °F).

3, For batteries employing series configurations, the test is repeated with a deliberately imbalanced battery. The imbalance is introduced into a fully discharged battery by charging one cell to approximately 50 percent of full charge.

Results

43 Normal Charging Operation Test						P
Cell No.	Measured Charging Voltage (V)	Cell rating voltage (V)	Measured Charging current (A)	Cell rating current (A)	Cell surface temperature (°C)	Specific Cell Configuration (charging)
1	5.0	4.25	1.5	1.75A per cell	53.6	0~40°C
2	5.0	4.25	1.5		56.2	0~40°C
3	5.0	4.25	1.5		55.1	0~40°C
Testing ambient temperature: 40°C						

43 Normal Charging Operation Test						P
Cell No.	Measured Charging Voltage (V)	Cell rating voltage (V)	Measured Charging current (A)	Cell rating current (A)	Cell surface temperature (°C)	Specific Cell Configuration (charging)
1	5.0	4.25	1.5	1.75A per cell	13.6	0~40°C
2	5.0	4.25	1.5		15.2	0~40°C
3	5.0	4.25	1.5		14.2	0~40°C
Testing ambient temperature: -5°C						

43 Normal Charging Operation Test						P
Cell No.	Measured Charging Voltage (V)	Cell rating voltage (V)	Measured Charging current (A)	Cell rating current (A)	Cell surface temperature (°C)	Specific Cell Configuration (charging)
1	5.0	4.25	1.5	1.75A per cell	50.6	0~40°C
2	5.0	4.25	1.5		50.4	0~40°C
3	5.0	4.25	1.5		51.6	0~40°C
Testing ambient temperature: 40°C Remark: cell no 1 charged to approximately 50 percent of full charge.						

43 Normal Charging Operation Test						P
Cell No.	Measured Charging Voltage (V)	Cell rating voltage (V)	Measured Charging current (A)	Cell rating current (A)	Cell surface temperature (°C)	Specific Cell Configuration (charging)
1	5.0	4.25	1.5	1.75A per cell	12.4	0~40°C
2	5.0	4.25	1.5		11.2	0~40°C
3	5.0	4.25	1.5		12.5	0~40°C
Testing ambient temperature: -5°C Remark: cell no 1 charged to approximately 50 percent of full charge.						

44 Lithium Charging System Test

Method:

1, Charring is defined as a blackening of the medical gauze or cheesecloth caused by combustion. Discoloration of the medical gauze or cheesecloth caused by smoke is acceptable.

Charring or igniting of the tissue paper, cheesecloth, or medical gauze from the shorting means in not considered a failure.

2, A sample of the power pack is placed on a soft wood surface covered by two layers of tissue paper; the sample is covered by one layer of untreated 100 percent cotton medical gauze or cheesecloth. The power pack is operated as specified in the operating instructions with all of the categories of abnormal conditions listed below in (a) – (d). The cumulative stress resulting from successive tests on electronic circuits or the battery is to be avoided. Additional samples may be used as necessary. There shall be no evidence of damage to the cell vent.

3, During the tests of 44.4, each cell voltage is continuously monitored to determine if it has exceeded the limit conditions. Venting of the cells is permitted. The test is continued until the sample under test experiences a failure as described in 44.1, returns to room temperature or, if neither of these, until at least 7 hours or twice the normal charging period has elapsed, whichever is longer.

4, Fault conditions for components as required by 44.4

Results

a) There ~~has~~ / has no explosion during this test; or

b) There ~~has~~ / has no charring or burning of the medical gauze, cheesecloth or tissue paper has resulted; or

c) The cells shall not have exceeded the upper limit charging voltage by more than 150 mV or, if they have, then the charging system shall be permanently disabled from recharging the battery.

44 Lithium Charging System Test					**P**
Cell No.	Measured charging Voltage (V)	Cell max. voltage (V)	Charging time (h)	Test condition (one single fault)	Remark
1	4.25	4.2	7	Q1 pin(1-4) SC	One of cell short
2	4.25	4.2			
3	4.25	4.2			
Cell No.	Measured charging Voltage (V)	Cell max. rated voltage (V)	Charging time (h)	Test condition (normal/one single fault)	Remark
1	4.25	4.2	7	Q1 pin(1-4) SC	one cell to approximately 50 percent of full charge
2	4.25	4.2			
3	4.25	4.2			
Cell No.	Measured charging Voltage (V)	Cell max. voltage (V)	Charging time (h)	Test condition (one single fault)	Remark
1	4.25	4.2	7	Q1 pin(1-4) SC	Battery fully charged
2	4.25	4.2			
3	4.25	4.2			

Remark: This test result (does/ ~~does not~~) comply with requirement of standard.

45 Capacitor Discharge Test N/A

Method:

1, A power pack provided with filtering capacitors, or other primary capacitors, rated in excess of 0.10μF and connected between one side of the line and ground, shall be subjected to this test.

2, The device shall be connected to a supply source of rated voltage at 60 Hz. The output shall be connected to a suitable load such that rated current is drawn from the output of the device. A storage oscilloscope shall be connected across the point of disconnection of the supply.

3, The device is connected to the source of supply and energized. The power is then removed and the resulting discharge curve for the stored charge on capacitors is measured and captured on the oscilloscope. The value of the stored charge shall decay to less than 37 percent of its initial value within 1 second.

4, The test is to be repeated with all switches in all possible positions and combinations.

Results

45 Capacitor Discharge Test		N/A
Capacitance	Voltage after 1 s (Vpeak)	initial value
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--	--	--
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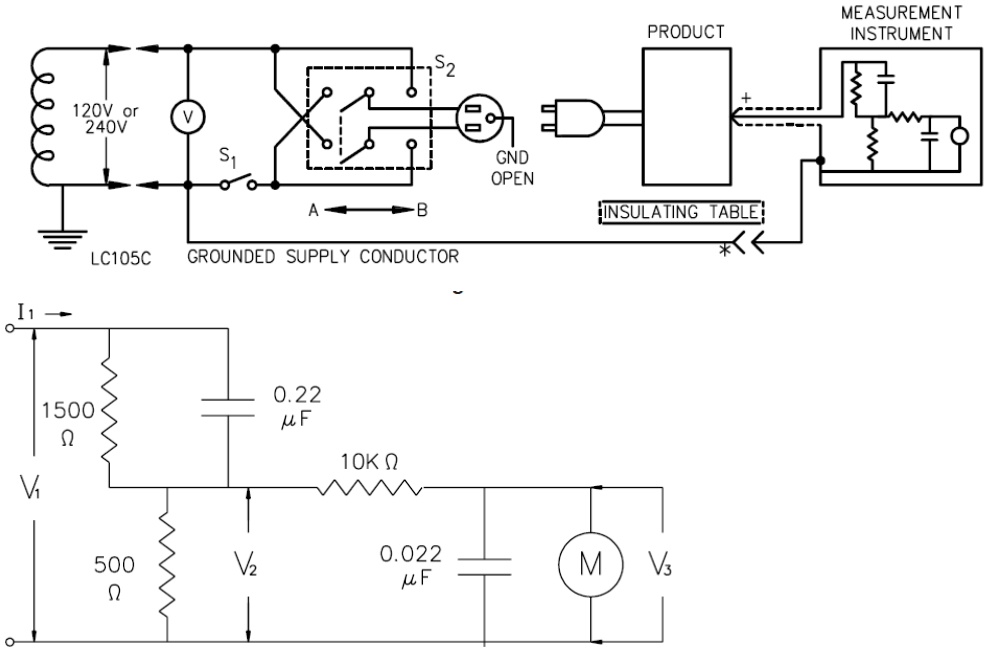
46 Leakage Current Test N/A

Method:

Connect the measure circuit as below:



Check the test instrument that S1, S2 is in well condition.

Then follow below sequence:

a) With switch S1 open, the EUT is to be connected to the measurement circuit. Leakage current is to be measured using both positions of switch S2, with the battery charger switching devices in all their intended operating positions.

b) Switch S1 is then to be closed, energizing the product. Within 5 seconds, the leakage current is to be measured using both positions of switch S2 and with the product switching devices in all their normal operating positions.

c) Leakage current is to be monitored until thermal stabilization. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operation as in the Normal Temperature Test, Section 47.

d) The leakage current is also to be monitored with switch S1 open while the product is at operating temperature and while cooling.

Measure the voltage of V2, V3 as shown above.
Limit: 0.5 mA

Measure point at below:

(a) between exposed conductive surfaces and the grounded pole of the supply circuit.

(b) between output circuits and the grounded pole of the supply circuit.

(c) others: _____

(d) others: _____

Results

Check switch S1: [ ] can open and close the circuit

Check switch S2: [ ] well connection and can change the polarities

46 Leakage Current Test (continuous) N/A

Input (V / Hz): _____

Model			Measured Leakage Current (measured V2, V3, mV)							
			Switch S2 Position 1				Switch S2 Position 2			
Condition	Switch S1		(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
As Received	Open	V3	--	--	--	--	--	--	--	--
	Closed, within 0-5 s	V3	--	--	--	--	--	--	--	--
	thermal stability	V3	--	--	--	--	--	--	--	--

The maximum measured V2 is _____, calculated the leakage current is _____ mA.

The maximum measured V3 is _____, calculated the leakage current is _____mA.

The result ([ ] complied / [ ] did not comply) with the requirements of UL 2743.

47.1 Normal Temperature Test

Method:

1, A power pack, when tested under the conditions of maximum normal load as described in 47.2, Maximum normal load, shall not reach a temperature high enough to cause a risk of fire, to damage any materials used, or exceed the temperature rises specified in Table 47.1. See Section 39, Surface Temperatures.

2, A thermal or overload protective device shall not open the circuit during the temperature test.

3, All values of temperature rise in Table 47.1are based on an assumed ambient temperature of 40°C (104°F).

4, For this test, the test voltage shall be the same as the rated voltage of the power pack.

5, A power pack shall be operated for a duration that is reasonable in comparison to its normal use. For example, when charging the internal battery, the duration of the charging function is complete when the battery is fully charged. See Maximum normal load, 47.2.

6, With reference to tests that are to be continued until thermal stabilization is obtained, thermal stabilization is considered to exist when three successive readings taken at intervals of 10 percent of the previously elapsed test duration, but not less than 5 minute intervals, indicate no change in temperature.

7, Coil winding temperatures are to be measured by thermocouples or by using the change-of-resistance method.

8, Test load refer to clause 47.2

Result:

47 Normal Temperature Test					
a) Charging: b)Discharging c)Charing and Discharging Input: DC5V, 1.65A MAX				Ambient temp.:	25
Ch.	Location	Actual Temp (°C) Correct to 40°C			Limit (°C)
		a)	b)	c)	--
1	Internal wire	50.6	45.1	52.2	80
2	PCB near Q4	80.2	76.4	82.4	130
3	PCB near U4	73.9	76.9	75.6	130
4	PCB near U5	76.4	67.6	78.7	130
5	PCB near U2	61.8	51.7	63.2	130
6	PCB near D2	65.2	55.3	66.6	130
7	PCB near Q9	77.1	56.3	77.9	130
8	Battery body	61.7	64.6	63.5	Ref
9	Battery output wire	47.4	54.8	50.4	80
10	Motor body	42.1	45.2	50.1	80
11	Enclosure near battery, inside	57.8	59.7	61.2	Ref
12	Enclosure near battery, outside	53.4	54.6	55.5	65
13	Button	44.4	43.8	46.7	65

Temperature rise of winding:	R1(Ω)	R_1( )	T (℃)	Required T(°C)	Insulation class
Primary Winding	--	--	--	--	--
Secondary Winding	--	--	--	--	--

Remark: load condition

47.3 Power pack ampacity temperature test

Method:

When conducting the Power pack ampacity test, see 65.1, the Power pack ampacity temperature test is also to be conducted. The Power pack ampacity test is conducted for a duration of 25 seconds, or whatever duration is allowed by the inherent functionality of the battery pack, at the end of duration the output of the power pack is to be turned-off. During this time the temperatures of the battery and all internal affected components, including cables, are to be recorded and are to be within the limits specified in Table 47.1. Additionally, the temperatures of the clamps are to be monitored from the start of the test and continuing through 2-minutes after the current is turned-off. At no time during this test shall the temperatures exceed those in Table 47.2:

Table 47.2
Maximum surface temperature rises on clamp

Clamp Location (portion adjacent to live-jaw)	Composition of surface			
	Metallic		Nonmetallic	
Area between pivot and jaw-ends of clamp	45°C	(81°F)	70°C	(126°F)
Handle portion of clamp-area between pivot and hand ends	25°C	(45°F)	35°C	(63°F)
Note – Maximum surface temperature rise of handle ends is based on UL Casualty Requirements for carrying and holding handles – Battery Booster Cables, SAE J1494 specifies 66°C (150°F) max.				

Input: 5V, 1.65A Max Output: __/__V, 60Hz, __/__ A, __/__W Charge the internal battery	Input: -- Output: --	Ambient temp.: 40	

Ch.	Location	Temp. Rise (°C)		Limit (°C)
1	Cell	49.6	64.6	ref
2	Enclosure inside(near cell)	41.2	56.2	ref
3	PCB near U4	68.7	83.7	130
4	PCB near U5	72.6	87.6	130
5	PCB near U2	70.8	85.8	130
6	Internal input wire	45.3	60.3	80
7	Internal output wire	58.9	73.9	80
8	Ambient	25°C	40°C	--

48 Dielectric Voltage Withstand Test N/A

Method:

While in a well-heated condition, a power pack shall withstand for 1 minute without breakdown the application of a 60 Hz essentially sinusoidal potential of:

a) 1000 volts plus twice the maximum rated voltage between:

1) The primary circuit and dead metal parts;

2) The primary and secondary circuits;

3) Secondary circuits operating above 50 V and dead metal parts; and

4) Secondary circuits operating above 50 V and secondary circuits operating below 50 V.

b) 500 volts between:

1) Secondary circuits operating below 50 volts and dead metal parts, and

2) Secondary circuits operating below 50 volts and other secondary circuits operating below 50 V.

Exception: The ac potentials shown above may be replaced with a dc potential equal to 1.414 times the ac potential for this test.

Result:

Potential between	**Test voltage**	**Result (P: pass / F: fail)**
Inverter AC part to Body	1250	
Inverter AC part to DC part	1250	
Output L and N	500	

49 Leakage Current Following Humidity Conditioning N/A

Method:

1, A power pack shall comply with the requirements for leakage current in Section 46, Leakage Current Test, following exposure for 48 hours to air having a relative humidity of 88 ±2 percent at a temperature of 32 ±2°C (90 ±4°F).

2, To determine whether a product complies with the requirement in 49.1, a sample of the power pack is to be heated to a temperature just above 34°C (93°F) to reduce the likelihood of condensation of moisture during conditioning. The heated sample is to be placed in the humidity chamber and is to remain for 48 hours under the conditions specified in 49.1.

3, Following the conditioning, the sample is to be tested as described in the Leakage Current Test, Section 46, while either in the humidity chamber or immediately after removal of the conditioned sample from the humidity chamber. For each test condition, the maximum leakage current is to be recorded and the test is to be discontinued when the leakage current stabilizes or decreases.

Result:

Input (V / Hz): _____

Model			Measured Leakage Current （measured V2, V3, mV）							
Condition	Switch S1		Switch S2 Position 1				Switch S2 Position 2			
			(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
~~As Received~~	~~Open~~	~~V2~~								
		~~V3~~								
	~~Closed, within 0-5 s~~	~~V2~~								
		~~V3~~								
	~~thermal stability~~	~~V2~~								
		~~V3~~								

~~The maximum measured V2 is _____, calculated the leakage current is _____ mA.~~

~~The maximum measured V3 is _____, calculated the leakage current is _____MIU.~~

~~The result ([ ] complied / [ ] did not comply) with the requirements of UL 2743.~~

50.2 Output short test

Method:

1, A power pack shall not emit flame or molten metal or become a risk of fire, electric shock, or injury to persons when subjected to the tests specified in 50.2 – 50.9. Separate samples are to be used for conducting each test, unless using a sample for more than one test is agreeable to all concerned.

2, With reference to 50.2.1, fuses and other protective devices provided as part of the power pack are to remain in the circuit. The output connections of the power pack are to be short-circuited at the connector and the power pack connected to a source of supply adjusted to its rated voltage. The test is to be continued until the internal protection opens or constant temperatures are obtained. When an automatically reset protector or a manually reset protector ends the test, the test is to be continued as indicated in 50.1.6.

3, If the power pack is provided with an output cable, then the short shall also occur at the end of the cable in order to judge that cables ability to withstand the fault for the duration.

1	DC OUTPUT	Test voltage: 5VDC Duration: 10mins Fuse No: F1 Input current(A): Temp: 36.5 Max. Voltage: 5VDC	☐ become steady, output current_____ ☒ shut down immediately ☐ protected, input power _____ ☐ T.F opened after _____ mins	☒ fuse opened immediately ☐ fuse opened after ____, current___ ☐ _____ damage, repeat 3 times ☐

Result:

After test, the sample (comply with/ ~~not comply with~~) 50.1.1

50.3 Reverse polarity

Method:

1, The power pack is to be tested in accordance with 50.3.2. The power pack shall comply with the requirements in 50.1.1.

2, With reference to 50.3.1, fuses and other protective devices provided as part of the power pack are to remain in the device. The output booster cable connections of the power pack are to be reverse connected to a fully charged battery. The test is to be continued until the internal protection opens or constant temperatures are obtained. When an automatically reset protector or a manually reset protector ends the test, the test is to be continued as indicated in 50.1.6.

Result:

After test, the sample (comply with/ ~~not comply with~~) 50.1.1

50.4 Component faults

Method:

A component, such as a capacitor, diode, solid state device, resistor, or similar component, connected in the power pack are to be short- or open-circuited, any two terminals one at a time, during any condition of operation including start-up. This test is not required where circuit analysis indicates that no other component or portion of the circuit is overloaded. At the end of each component fault condition, the power pack shall comply with the requirement in 50.1.1.

Result:

Component name	Condition (short or open)	Result (P: pass / F: fail) and remark
Q4(pin G-S)	short	P: unit shut down immediately, no hazards, no damage.
Q4(pin G-D)	short	P: unit shut down immediately, no hazards, no damage.
Q4(pin S-D)	short	P: unit shut down immediately, no hazards, no damage.
U4(pin 1-6)	short	P: unit shut down immediately, no hazards, no damage.
D2	short	P: unit shut down immediately, no hazards, no damage.
D4	short	P: unit normal operation, no hazards, no damage.
C13	short	P: unit shut down immediately, no hazards, no damage.
R17	short	P: unit shut down immediately, no hazards, no damage.

After test, the sample (comply with/~~not comply with~~) 50.1.1

50.5 Relay and solenoid burnout N/A

Method:

An electromagnetic relay or a solenoid having an open coil construction is to be tested by blocking the armature or the plunger in the de-energized position. The test shall be continued until constant temperatures are obtained or for 7 hours maximum. The test results shall comply with 50.1.1.

Result:

Relay name	Condition (block)	Result (P: pass / F: fail) and remark
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--

After test, the sample (comply with/ not comply with) 50.1.1

50.6 Printed wiring board abnormal test

Method:

1, To comply with Exception No. 1 to 29.1, a printed wiring board is to be tested as described in 50.6.2 – 50.6.5.

2, During this test, if a printed wiring board trace opens, the gap is to be electrically shorted and the test continued until ultimate results occur. This procedure applies to each occurrence. If the circuit is interrupted by the opening of a component other than described in 50.6.3, the test is to be repeated two more times using new components as necessary.

3, Operation of an overcurrent protective device other than the branch circuit overcurrent protective device is allowed.

4, A sample of the power pack employing a printed wiring board is to be connected to its rated supply voltage. A foil trace is to be short-circuited to each of its adjacent traces that do not have the spacing specified in Table 29.1, one at a time.

5, The test is to be continued for 1 hour or until one of the conditions described in 50.1.3 occurs. However, if at the end of 1 hour no condition described in 50.1.3 occurs, but indications are that such a condition may eventually occur, the test is to be continued until ultimate results are obtained (usually 7 hours).

Result:

PCB trace between	Condition (short)	Result (P: pass / F: fail) and remark
U4 pin 1 and pin 4	short	Pass
U4 pin 1 and pin 6	short	Pass
Q4 pin G and pin S	short	Pass
Q4 pin D and pin S	short	Pass

After test, the sample (comply with/ ~~not comply with~~) 50.1.1

50.7 Disconnected fan test N/A

Method:

A device having forced ventilation is to be operated with the fan disconnected. For a device having more than one fan, the test is to be conducted with each fan disconnected, one at a time, or with two or more fans disconnected, if they are controlled or powered by the same connection. If part of the circuitry senses a disconnected fan and shuts down the unit, the circuitry shall be bypassed to allow operation with the fans disconnected or the circuitry shall be evaluated for suitability of this protective function.

Result:

Fan Name	Condition (short/open)	Result (P: pass / F: fail) and remark
~~Fan~~	~~disconnected~~	

After test, the sample (comply with/ not comply with) 50.1.1

50.8 Blocked ventilation test N/A

Method:

A power pack provided with ventilation openings for allowing air flow to cool internal components shall be subjected to this test. The vents shall be blocked, and the unit shall be operated at maximum normal load, as defined in 47.2. The test shall be continued until constant temperatures are obtained or for 7 hours maximum. During the test, the power pack shall comply with 50.1.1.

Result:

After test, the sample (comply with/ not comply with) 50.1.1

50.9 Overcharging test

Method:

1, Power packs shall withstand abusive overcharging without risk of fire or explosion when tested in accordance with 50.9.2.

2, The battery is placed on a soft wood surface covered by two layers of tissue paper and the sample is covered by one layer of untreated 100 percent cotton medical gauze and charged at a rate of 10 times the manufacturer is recommended rate for the battery for 1.25 hours or at the maximum output that is available from an external source provided with the pack. There shall be no explosion and no charring or burning of the gauze or tissue paper. Charring is defined as a blackening of the gauze caused by combustion. Discoloration of the gauze caused by smoke is acceptable. Venting of the cells is acceptable

Result:

Charging time(h)	Max measured charge current(A)	Setup charge voltage(V)	Setup charging current(A)	Result
1.25	2.67	5	10	pass

After test, the sample (comply with/ ~~not comply with~~) 50.1.1 and (~~with~~ / without) risk of fire or explosion.

50.10 Internal battery reverse polarity test N/A

Method:

1, For power packs with removable internal batteries that are not keyed or otherwise prevented from being connected incorrectly, the test of 50.10.2. is carried out and the pack shall comply with 50.1.1.

2, During this test, fuses and other protective devices provided as part of the power pack are to remain in the device. Two samples are to be tested. The first sample is tested by connecting a fully discharged internal battery in reverse polarity and then attempting to charge the internal battery with a normal charging cycle. The second sample is tested by connecting a fully charged internal battery in reverse polarity and then attempting to use the pack under the conditions of maximum normal load. In both cases, the test is to be continued until the internal protection opens or constant temperatures are obtained. When an automatically reset protector or a manually reset protector ends the test, the test is to be continued as indicated in 50.1.6.

Result:

Precondition	Max. temperature of cell casing (°C)	Output Load	Remark
Fully charged battery	--	--	--
Fully discharged battery	--	--	--

After test, the sample (comply with/ not comply with) 50.1.1

51 Vibration test

Method:

1, Cells shall not catch fire nor explode during or immediately following this conditioning.

2, The vibration test shall consist of vibration for 4 hours at a frequency of 22 cycles per second with a displacement of 1/4 inch (6.4 mm) in a vertical plane. The unit is to be mounted as intended during the test.

Result:

After test, the sample (comply with/~~ not comply with~~) 50.1.1 and the cell (~~with~~ / without) catch fire or explode.

52 Ground Continuity N/A

Method:

1, The resistance between the point of connection of the equipment-grounding means at or within the product and any other point in the grounding circuit of the product shall not be more than 0.1ohm as determined by an ohmmeter or other equivalent means.

2, If unacceptable results are observed with an ohmmeter, a low voltage current source can be employed. With the low voltage current source, an alternating current of 25 A (for 15 A maximum rated products) from a power supply of 12 V or less is to be passed for one minute minimum. The current shall be passed from the point of connection of the equipment grounding means to the metal part in the grounding circuit under test. The resulting drop in potential is to be measured between the two points.

Result:

52 Ground Continuity					N/A
Current Rating (A)	Measured point	Test condition			Measured (mΩ or V)
--	--	V,	A,	min.	--
--	--	V,	A,	min.	--

53.2 Overload of switches and controls test N/A

Method:

1, Unless known to be evaluated for the application, a switch or other control device shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation making and breaking the load. For this test, the load may be the actual load applied in the product, or if this is unknown, the load shall be based on the rating of the switch or control device. As a result of this overload test there shall be no electrical or mechanical breakdown of the device, undue burning or pitting of the contacts, or opening of the fuse in the grounding connections.

2, To determine whether a switch or other control device complies with the requirements in 53.2.1, the power pack is to be connected to a supply circuit of rated frequency and the maximum rated voltage (or a fully charged power pack). The load for the device under test is to be the same as that which it is intended to control in regular service. During the test, accessible dead metal parts of the power pack are to be connected to ground through a 3-ampere plug fuse. The device is to be operated at a rate of not more than 10 cycles per minute, except that a faster rate of operation may be employed if agreeable to those concerned.

Result:

53.2 Overload of switches and controls test			N/A
Device name	Test condition	Cycle / Frequency	Remark
--	V, A,	50 cycle, 10 times/min	--
--	--	--	--
--	--	--	--

After test, the sample

1, (With / without) electrical or mechanical breakdown of the device, undue burning or pitting of the contacts,

2, (With / without) opening of the fuse in the grounding connections.

53.3 Overload of protection devices N/A

Method:

1, An overload protective device shall be cycled through 200 operations of make and break action. The device shall be connected to the voltage present in the end product and the current load shall be adjusted to be equal to the maximum load seen by the device in the end product. The device shall be cycled at 10 cycles per minute, or faster is all involved agree. At the end of the 200 cycles, the device shall be able to operate as intended..

Result:

53.3 Overload of protection devices			
Device name	Test condition	Cycle / Frequency	Remark
	V, A,	200 cycle, 10 times/min	

After test, the device (does / doesn't) able to operate as intended

53.4 Overload of interlocks N/A

Method:

1, The contact of the safety interlock switch or relay is subjected to an overload test consisting of 50 cycles of operation at the rate of 6 to 10 cycles per minute, making and breaking 150 percent of the current imposed in the application, except that where a contact switches a motor load, the test is conducted with the rotor of the motor in a locked condition. After the test, the switch or relay shall still be functional.

Result:

53.4 Overload of interlocks			
Device name	Test condition	Cycle / Frequency	Remark
	V, A,	50 cycle, 10 times/min	

After test, the device (with / without) normal function.

54.1 Strain Relief test N/A

Method:

1, The strain relief means provided on a flexible cord shall withstand for 1 minute without displacement a direct pull of 35 pounds (156 N) applied to the cord, with the connections within the power pack disconnected. At the point of disconnection of the conductors, there shall be no movement of the cord as to indicate that stress on the connections would have resulted from the pull force.

2, A 35-pound (15.9-kg) weight is to be suspended from the cord and supported by the power pack so that the strain relief means is stressed from any angle the construction of the power pack permits.

Results:

[ ] Power supply cord: (force) _____

[ ] Output cord: (force) _____

After test, the cord

1, (with / without) displacement

2, at the end of the disconnection in the enclosure, there (with / without) movement

54.2 Push-back strain relief test N/A

Method:

The supply cord or lead is to be held 1 inch (25.4 mm) from the point where the cord or lead emerges from the product and is then to be pushed back into the product. When a removable bushing which extends further than 1 inch is present, it is to be removed prior to the test. When the bushing is an integral part of the cord, the test is to be carried out by holding the bushing. The cord or lead is to be pushed back into the product in 1-inch (25.4-mm) increments until the cord buckles or the force to push the cord into the product exceed 6 pounds-force (26.7 N).

Results:

[ ] Power supply cord: (force) _____

[ ] Output cord: (force) _____

After test, the cord (can /can not) push back into the product.

55.2 Impact test N/A

Method:

1, Two samples of the power pack are subjected to this test. The first sample is tested in the as-received condition. The second sample is conditioned in a cold chamber at 0°C (32°F) for 4 hours. The sample is to be removed from the cold chamber and immediately subjected to the impact described in 55.2.2. During handling of the sample, gloves shall be worn to minimize heat transfer

2, An enclosure, guard, or cover is to be subjected to an impact of 5 foot-pounds (6.78 N-m) on any surface that may be subjected to an impact during intended use. The impact is to be produced by dropping a steel sphere, 2 inches (50.8 mm) in diameter and weighing approximately 1.18 pounds (0.535 kg), from a height of 51 inches (1.30 m). For surfaces other than the top, the steel sphere is to be suspended by a cord and allowed to swing as a pendulum dropping through a vertical distance of 51 inches. The impact shall be applied one time to each surface that is exposed to a blow during any condition of intended use.

Results:

Sample 1:

After test, the test probe [ ] can / [√] cannot contact hazardous live part

After test, [ ] with / [√] without a permanent distortion of a metallic enclosure that reduces spacings

Dielectric Voltage Withstand Test

Potential between	Test voltage	Result (P: pass / F: fail)
Inverter AC part to body	1250	
Inverter AC part to DC part (USB output)	1250	
Output L and N	500	

Sample 2:

Condition: [√] 0℃ 4 hours

After test, the test probe [ ] can / [√] cannot contact hazardous live part

After test, [ ] with / [√] without a permanent distortion of a metallic enclosure that reduces spacings

Dielectric Voltage Withstand Test

Potential between	Test voltage	Result (P: pass / F: fail)
Inverter AC part to body	1250	
Inverter AC part to DC part (USB output)	1250	
Output L and N	500	

55.3 Drop test

Method:

1, Two samples of the power pack are subjected to this test. The first sample is tested in the as-received condition. The second sample is conditioned in a cold chamber at 0°C (32°F) for 4 hours. The sample is to be removed from the cold chamber and immediately subjected to the impact described in 55.3.2. During handling of the sample, gloves shall be worn to minimize heat transfer. Following the test, the power pack shall be in accordance with 55.1.1 (a) – (c).

2, The sample is to be dropped three times from a height of 3 feet (0.9 m) to strike a concrete surface in the positions most likely to produce adverse results.

Results:

Sample 1:

After test, the test probe [ ] can / [√] cannot contact hazardous live part

After test, [ ] with / [√] without a permanent distortion of a metallic enclosure that reduces spacings

Dielectric Voltage Withstand Test

Potential between	Test voltage	Result (P: pass / F: fail)
Inverter AC part to body	/	/
Inverter AC part to DC part(USB output)	/	/
Output L and N	/	/

Sample 2

Condition: [√] 0℃ 4 hours

After test, the test probe [ ] can / [√] cannot contact hazardous live part

After test, [ ] with / [√] without a permanent distortion of a metallic enclosure that reduces spacings

Dielectric Voltage Withstand Test

Potential between	Test voltage	Result (P: pass / F: fail)
Inverter AC part to body	/	/
Inverter AC part to DC part(USB output)	/	/
Output L and N	/	/

56 Mold Stress Test

Method:

1, One sample, consisting of the complete equipment or the complete enclosure, is subjected to this test.

2, The sample shall be placed in an air circulating oven at a temperature equal to 10 degrees higher than the maximum temperature observed on the enclosure during the temperature test, but not less than 80°C (176°F) or 70°C (158°F) if marked in accordance with 70.23. The sample was conditioned in the oven for 7 hours.

3, After the conditioning, the sample shall not show any signs of distortion, deterioration, shrinkage, warping, or softening that would allow access to live parts.

Results:

The oven temperature__70___°C, 7 hours.

After test, [ ] with / [√] without any signs of distortion, deterioration, shrinkage, warping, or softening that would allow access to live parts.

57 Strength of Handles Test N/A

Method:

1, A handle used to lift or carry a power pack shall withstand a force of four times the weight of the power pack without breakage of the handle, its securing means, or that portion of the enclosure to which the handle is attached.

2, To determine whether a power pack complies with the requirements in 57.1, a force equal to four times the weight of the power pack is to be uniformly applied over a 3-inch (76-mm) width at the center of the handle, without clamping. The load is to be started at zero and is to be gradually increased so that the test value will be attained in 5 to 10 seconds and maintained at that value for 1 minute. If more than one handle is provided on a power pack and the power pack cannot be carried by one handle alone, the force is to be distributed between the handles. The distribution of forces is to be determined by measuring the percentage of the weight of the power pack sustained by each handle with the power pack in the normal carrying position. If a power pack is furnished with more than one handle and can be carried by one handle only, each handle shall withstand the total force.

Results:

The weight of the product_____kg

The force on the handle_____N

The count of the handle_____

After test, [ ] with / [ ] without breakage of the handle.

58 Stability Test N/A

Method:

1, Under conditions of normal use, a power pack shall not become physically unstable to the degree that it poses a risk of injury to persons.

2, A power pack shall not tip over but shall return to its normal at rest position when:

a) Tipped through an angle of 10 degrees from an at rest position on a horizontal surface, or

b) Placed on an inclined plane inclined at an angle of 10 degrees from the horizontal.

3, A power pack is not to be energized during this test. The test is to be conducted under conditions most likely to cause the power pack to overturn.

4, With reference to the requirements in 58.2, for a power pack that is constructed so that while being tipped through an angle of 10 degrees, a part or surface of the power pack not normally in contact with the horizontal supporting surface touches the supporting surface before the power pack has been tipped through an angle of 10 degrees, the tipping is to be continued until the surface or plane of the surface of the power pack originally in contact with the horizontal supporting surface is at an angle of 10 degrees from the horizontal supporting surface.

Results:

The product [ ] comply with / [ ] doesn't comply with stability test.

59 Hydrostatic Strength Test N/A

Method:

1, A hydrostatic strength test is to be conducted by filling the pressure confining portion of the sample with water so as to exclude all air, connecting the sample to a hydraulic pump, gradually increasing the pressure to the specified test value, and holding it for a period of 1 minute. As a result of the test, the pressure confining portion of the sample shall withstand without rupture a test pressure of five times the maximum pressure developed by the system, or five times the rated pressure of the power pack's air compressor, whichever is greater. Prior to the test, parts molded of polymeric material are to be conditioned in an air circulating oven for 7 hours at a temperature of 70°C (158°F) or 10°C (18°F) higher than the maximum temperature measured on the part under normal load, whichever is greater. The samples are to be removed from the oven and allowed to cool to room temperature prior to the test.

Results:

The oven temperature_____°C, 7 hours.

The rated pressure of the power pack's air compressor_____

The maximum pressure developed by the system_____

Five times of above of the most pressure_____

After test, the product [ ] with / [ ] without the rupture

60 Rain Test N/A

Method:

1, The following test shall be performed on all power packs that are designated outdoor use or temporary outdoor use.

2, Enclosures shall have no water higher than the lowest live part inside the enclosure at the conclusion of this test or the power pack shall be subject to the Leakage Current Test in accordance with

clauses 46.2 – 46.7.

3, After the exposure, the outside of the enclosure is to be dried with a towel and the enclosure is

opened. The product is inspected for the presence of water in accordance with 60.1.

Exception: For Rainproof only; units may instead be subject to the Leakage Current test as the pass/fail criteria in accordance with clauses 46.2 – 46.7

Results:

Type: [ ] Rainproof / [ ] Raintight

For Rainproof, there[ ] has /[ ] has not water in the enclosure

For Raintight type, there [ ] has / [ ] has not water higher than the lowest live part inside the enclosure

Input (V / Hz): _____

Model			Measured Leakage Current （measured V2, V3, mV）							
Condition	Switch S1		Switch S2 Position 1				Switch S2 Position 2			
			(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
As Received	Open									
		V3								
	Closed, within 0-5 s									
		V3								
	Thermal stability (N/A FOR THIS CLAUSE)									
		V3								

The maximum measured V3 is _____, calculated the leakage current is _____MIU.

61 Tests on Insulating Materials N/A

Method:

1, As required by 29.11, insulating material shall be subjected to this test and shall withstand without electrical breakdown the potential indicated in 61.2.

2, Exception No. 1: The insulating material need not be subjected to this test if it is generic material noted in Table 61.1. See 61.3.

Exception No. 2: An insulating system consisting of N multiple layers of any thickness need not be tested in accordance with 61.2 if all possibilities of N-1 [N minus 1] layers withstand double the test potential defined in the Dielectric Voltage Withstand Test, Section 48, and applied as described in 61.2. “N” must be a minimum of 2 layers.

3, The insulating material is to be placed between two opposing electrodes. The electrodes are to be cylindrical brass or stainless steel rods 1/4 inch (6.4 mm) in diameter with edges rounded to a 1/32 inch (0.8 mm) radius. The upper moveable electrode is to weigh 1.76 ±0.07 ounces (50 ±2 grams) to exert sufficient pressure on the specimen to provide good electrical contact. The test potential shall be as indicated in the Dielectric Voltage Withstand Test, Section 48, and is to be maintained for 1 second.

4, With reference to Exception No. 1 to 61.1, insulation may be of a generic material type specified in Table 61.1 where the layer(s) of each generic material is of a minimum thickness such that all layers collectively are greater than or equal to the minimum thickness required (T):

$$T \leq A_1(EF_1) \pm A_2(EF_2) \pm A_3(EF_3)$$

In which:

A1, A2, and A3 denote the total thickness of each generic material type, inches (mm);

EF1, EF2, and EF3 denote the equivalency factor specified in Table 61.1 for the generic material type corresponding to A1, A2, A3;

T is the thickness requirement for electrical grade paper.

Results:

Parts under test	Test voltage	Total layers	The layers for test	Result (P: pass / F: fail)
Insulation sheet (Tape around T1)				

62 Accelerated Aging of Gaskets, Sealing Compounds, and Adhesives Test N/A

Method:

1, The requirements in 62.2 – 62.6 apply to gaskets and sealing compounds employed to make an enclosure raintight or rainproof as determined by the Rain Test, Section 60. The requirements in 62.7 apply to an adhesive used to secure a gasket.

2, Neoprene and rubber gasket materials shall have physical properties as specified in Table 62.1 before and after accelerated aging under the conditions specified in Table 62.2.

3, Foamed neoprene and foamed rubber gasket materials shall be subjected to accelerated aging under the conditions specified in Table 62.2. The material shall not harden or otherwise deteriorate to a degree that affects its sealing properties.

4, Thermoplastic gasket materials shall be subjected to accelerated aging under the conditions specified in Table 62.2. A thermoplastic material shall not deform or melt, or otherwise deteriorate to a degree that will affect its sealing properties. A solid polyvinyl chloride material shall have physical properties as specified in Table 62.1 before and after the accelerated aging.

5, Tensile strength and elongation are to be determined using the test methods and apparatus described in Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension, ASTM D412.

6, A sealing compound shall be applied to the surface it is intended to seal. For a temperature rise not exceeding 35°C (63°F), a representative sample of the surface with the sealing compound applied shall be conditioned for 7 days in an air oven at 87.0 ±1.0°C (189.0 ±1.8°F). The sealing compound shall not melt, become brittle, or otherwise deteriorate to a degree that will affect its sealing properties as determined by comparing the aged sample to the unaged sample.

7, For a gasket secured by an adhesive and subject to a temperature rise not exceeding 35°C (63°F), a sample of the gasket secured to the mounting surface by the adhesive shall be exposed for 72 hours to each of the following conditions:

a) A temperature of 100.0 ±1.0°C (212.0 ±1.8°F);

b) Immersion in distilled water at a temperature of 23.0 ±1.0°C (73.0 ±1.8°F); and

c) A temperature of minus 10.0°C (14.0 ±1.8°F).

The force required to peel the gasket from its mounting surface after exposure shall not be less than 50 percent of the value determined using an unconditioned sample, but not less than 2 pounds per inch (0.04 kg/mm) of gasket width.

8, The temperature rises specified in this section correspond to the maximum temperature rise measured on the gasket during the temperature test. A material other than those specified in this section shall be non-absorptive and it, and all materials having a higher temperature rise, shall provide the resistance to aging and temperatures for the application.

Table 62.1
Physical properties for gaskets

Property	Neoprene or rubber compound		Polyvinyl chloride material	
	Before conditioning	After conditioning	Before conditioning	After conditioning
Recovery – Maximum set when 1 inch (25.4 mm) gage marks are stretched to 2-1/2 inches (63.5 mm), held for 2 minutes, and measured 2 minutes after release	1/4 inch (6.4 mm)	–	Not Specified	
Elongation – Minimum increase in distance between 1 inch (25.4 mm) gage marks at break	250 percent	85 percent	250 percent	75 percent
	[1 to 3-1/2 inches of original (25.4- 88.9 mm)]		[1 to 3-1/2 inches of original (25.4 – 88.9 mm)]	
Tensile Strength – Minimum force at breaking point	850 psi (5860 kPa)	75 percent of original	1200 psi (8273 kPa)	90 percent of original

Table 62.2
Accelerated aging conditions

Measured temperature rise °C	(°F)	Rubber and neoprene	Thermoplastic
35	(63)	Air oven aging for 70 hours at 100°C (212°F)	168 hours in an air circulating oven at 87.0 ±1.0°C (188.6 ±1.8°F)
50	(90)	Air oven aging for 168 hours at 100°C (212°F)	240 hours in an air circulating oven at 100.0 ±1.0°C (212 ±1.8°F)
55	(99)	168 hours in an air circulating oven at 113.0 ±1.0°C (235.4 ±1.8°F)	168 hours in an air circulating oven at 113.0 ±1.0°C (235.4 ±1.8°F)
65	(117)	240 hours in an air circulating oven at 121.0 ±1.0°C (249.8 ±1.8°F)	168 hours at 121.0 ±1.8°C (249.8±1.8°F) or 60 days at 97.0 ±1.0°C (206.6 ±1.8°F) in an air circulating oven
80	(144)	168 hours in an air circulating oven at 136.0 ±1.0°C (276.8 ±1.8°F)	168 hours in an air circulating oven at 136.0 ±1.0°C (276.8 ±1.8°F)

Result:

Neoprene and rubber gasket materials, A solid polyvinyl chloride material [ ] is / [ ] isn't have specified physical properties after test;

Foamed neoprene, foamed rubber gasket materials and A thermoplastic material [ ] is / [ ] isn't harden or otherwise deteriorate;

This result ([ ] was complied / [ ] was not complied) with the requirements of Paragraph 62 .

64 Permanency of Wrapped Hang Tag Marking N/A

Method:

1 Following the test described in 64.2 – 64.5, the marking shall be considered permanently affixed when there is no indication of the results shown in (a) – (d). Manipulation of the hang tag, such as straightening by hand, is allowed when determining compliance with these requirements.

a) Tearing at any point for more than 1/16 inch (1.6 mm);

b) Movement of the tag more than 1/2 inch (12.7 mm) along the length of the cable;

c) Shrinkage, wrinkling, cracking, or other deformation that renders the marking illegible; or

d) Visible curling or loosening around the edges of a tag with an adhesive back.

2 Nine samples of a hang tag are to be tested as described in 64.5. Each sample is to consist of a length of cable to which the hang tag has been attached in the intended manner. If the hang tag is secured by an adhesive, the test is to be conducted no sooner than 24 hours after application of the hang tag.

Three samples are to be tested as received; the additional samples are to be conditioned as described in 64.3 and 64.4 prior to testing.

3 Three samples are to be conditioned for 240 hours in an air-circulating oven maintained at a uniform temperature of 87.0 ±1.0°C (188.6 ±1.8°F). Following removal from the oven, the samples are to remain at a temperature of 23.0 ±2.0°C (73.4 ±3.6°F) and a relative humidity of 50 ±5 percent for 30 minutes before testing.

4 Three additional samples are to be conditioned for 72 hours at a temperature of 32.0 ±2.0°C (89.6 ±3.6°F) and a relative humidity of 85 ±5 percent. The samples are to be tested within 1 minute after exposure.

5 Each sample cable with attached hang tag is to be tightly suspended and clamped at each end in a vertical plane with the attachment plug or fitting pointing upward. A 5-lb (22.2 N) force is to be applied for 1 minute at the uppermost corner of the tag farthest from the cable and within 1/4 inch (6.4 mm) of the vertical edge of the hang tag. The force is to be applied vertically downward in a direction parallel to the major axis of the cable.

Result:

1, The tags in 64.2 comply with [ ] / does not comply with [ ] clause 64.1

2, The tags in 64.3 comply with [ ] / does not comply with [ ] clause 64.1

3, The tags in 64.4 comply with [ ] / does not comply with [ ] clause 64.1

65 Power Pack Ampacity Test N/A

Method:

A lead-acid power pack with a booster function shall be subject to the Power Pack Ampacity Test for 10 seconds. Lead acid batteries shall be loaded such that the constant output voltage is 7.2 volts. For Lithium-Ion powered units with protection circuitry, the Power Pack Ampacity test is conducted for 5-seconds and the battery packs may be loaded to the lowest constant output voltage that the battery pack will allow, and this constant voltage will also be included with the battery pack's rating, along with the time duration of the ampacity output. The ampacity shall be recorded for the duration of the test. At the end of the test the ampacity shall be recorded and this shall be the power pack's ampacity rating. The Power pack ampacity temperature test, see 47.3, is conducted at the same time as the Power Pack Ampacity Test, but note it is continued longer than to obtain the Ampacity rating.

Result: The current is _____A

66 Back Feed Test

Method:

1, Under both normal operation and single fault conditions, the voltage present at the input connections when the power pack is not connected to the power source shall not exceed 60 V dc, and the available current shall not exceed 3.5 mA.

2, A power pack with a fully charged internal battery is to be subjected to this test. The input connection is connected to suitable meters to measure the voltage and current available at the input connection point when the power pack is disconnected from the power source. Following these measurements, component faults are simulated, one at a time, and the measurements are repeated. All component faults required to determine compliance shall be performed. In all cases, the values measured for voltage and current shall not exceed the limits in 66.1.

Result:

66 Back Feed Test			P
	Ambient temperature (°C) ……..:	25	
No.	Components fault	Input terminal voltage and current	Remark
1	--	5Vdc, 0.02mA	pass
2	U2(pin1-4)	5Vdc, 0.02mA	pass
3	U2(pin1-6)	5Vdc, 0.02mA	pass
4	U4(pin1-4)	5Vdc, 0.02mA	pass
5	U4(pin1-6)	5Vdc, 0.02mA	pass
Supplementary information			
S: Short-circuited; O: Open-circuited; O/L: Overloaded Max. Voltage: the maximum accessible voltage during the fault condition.			

67 Cold Bend Test N/A

Method:

67.1 As directed in 12.2.2.4, samples of the cable shall be subjected to the Cold Bend Test described in 67.2. There shall be no evidence of cracks on the inside or outside surfaces after the test has been completed.

67.2 The specimens and the appropriate mandrel, as specified in Table 67.1, are cooled for a period of 4 hours at minus 40°C ±2°C (minus 40°F ±4°F). After this cooling period, the specimens are wound onto the mandrel for six complete turns. The winding is to be done at a rate of about 3 seconds per turn, and successive turns are to be in contact with one another. The test is to be performed in the cold chamber where space and mounting means are available in the chamber. Where this is not practical, it is appropriate to remove a specimen and a mandrel from the test chamber and perform the test outside the chamber. In either case, the winding is to be completed within 30 seconds of the time that the cold chamber is opened.

Table 67.1
Mandrel diameters

Size of conductor, AWG	Mandrel diameter	
	in.	(mm)
10	0.563	(14.30)
8	0.688	(17.48)
6	1.250	(31.75)
4	1.375	(34.93)
2	1.563	(39.70)
1	2.688	(68.28)
–	–	–
1/0	2.875	(73.03)
2/0	3.000	(76.20)
3/0	3.250	(82.55)
4/0	3.500	(88.90)

Result:

The supply cable with [ ] / without [ ] cracks on the inside or outside surfaces

The output cable with [ ] / without [ ] cracks on the inside or outside surfaces

68.2 Cold drop test N/A

Method:

1, Following exposure to this test, there shall not be significant deterioration of physical properties of

the integrally coated insulation as determined by a visual examination for the presence of cracks, peeling, deformation, eroding, excessive wear, or other imperfections of the insulating material that result in exposing the surface of the metal clamp

2, Three samples of the insulated clamp are to be subjected to a low-temperature exposure for one hour consisting of a conditioning temperature based on its lower ambient rating as indicated in 12.2.3. The samples are then dropped 5ft (1500 mm) onto a concrete surface. Following this exposure, the samples are to be subjected to the Dielectric voltage-withstand test in 68.3.

Precondition under temperature___-25 / -45__ °C

Low ambient storage rating:

Result:

After test, the clamp comply with [ ] / does not comply with [ ] clause 8.2.1.

68.3 Dielectric voltage-withstand test N/A

Method:

1, Samples of the insulated clamp are to be subjected to this test with no indication of dielectric breakdown.

2, A 500 volt, 60 Hz potential is to be applied between:

a) The connector and foil wrapped around the handle of the clamp;

b) The connector and the assembly rivet; and

c) The connector and the clamp spring.

Exception No. 1: The test potential of 500 V ac specified may be replaced by a dc voltage of 707 V.

Exception No. 2: Assembly rivets or coil springs recessed against contact are not required to be tested.

Result:

Potential between	Test voltage	Result (P: pass / F: fail)
The connector and foil wrapped around the handle of the clamp	500V	
The connector and the assembly rivet	500V	
The connector and the clamp spring	500V	

68.4 Secureness test N/A

Method:

1, The connection between cable and clamp shall be intact with no broken insulation after the test of 68.4.2.

2, The clamp is secured in a manner that allows the cable to hang freely in a downward position. A weight equal to 2 times the weight of the power pack is applied to the cable and supported by the cable for 10 minutes. At the end of the 10 minutes, the connection and insulation is observed

Result:

The weight of the product:_____kg

The pull force _____N, 10 min

After test, the connection between cable and clamp with [ ] / without [ ] broken insulatio

UL 1450 Test data

35 Moving Rotating or Moving Members

A rotating member employed in a product provided with a **series motor** shall be constructed so as to reduce the likelihood of its breakage, or the release or loosening of a part that could become a risk of injury to persons.

Test Method:

The product is to be operated for 1 min at the no-load speed resulting from application of 1.3 times rated voltage.

Test voltage: 1.3 x 5V=6.5V

Test Result:

Parts that can cause an injury to persons (~~did /~~ did not) worked loose.

Conclusion:

This result (complied /~~ did not comply ~~) with the requirements.

45 Input Test

Test Method

The sample was connected to its rated 120 V, 60 Hz source of supply and operated until well heated. The outlet was restricted and/or adjusted sufficiently to cause a maximum wattage input to the product.
1) A product, when tested under the conditions of maximum normal load as described in 46.2.1 – 46.2.7, shall not reach a temperature high enough to cause a risk of a fire, to damage any materials used, or exceed the temperature rises specified in Table 46.1. See Section 32, Surface Temperature.
2) A thermal- or overload-protective device shall not open the circuit during the temperature test.
3) All values of temperature rise in Table 46.1 are based on an assumed ambient temperature of 25°C (77°F). Tests may be conducted at any ambient temperature within the range of 10 – 40°C (50 – 104°F).

Test Result

Model	Supply Voltage (V)	Current (A)	Wattage (W)	Marked Rating (A)	Current Limit (A)	Pressure (psi)	PF
HZ009	DC5V	1.65	8.25	2	2.2	150	--

The measured power input (was ~~/ was not~~) within the range of 85%~110% of its marked rating.

Conclusion

This result (complied ~~/ did not comply~~) with the requirements.

46 Temperature Test

Test Method

The sample was operated with a duty cycle of 2 minutes on and 15 minutes off until stable condition was obtained. Temperatures were obtained at the locations noted next page. During this operation, the outlet was restricted to case maximum wattage input as noted in the input test.

Test Result

The sample (~~did /~~ did not) obtain a temperature at any point high enough to constitute a risk of fire or to damage any material employed in the appliance.
The sample (~~showed /~~ did not show) greater temperature rises at certain specified points itemized on the next page.

The overload-protective device (~~did /~~ did not) open.

Conclusion

These results (complied / ~~did not comply~~) with the requirements.

Temperature Test (Con'd)

Input: DC5V, 8.25 W

RESULTS:

Ch.	Location	Temp rise. (K)			Temp rise. Limit (K)
		DC5 V	Battery discharge	Charge and discharge	
1	Internal wire	50.6	45.1	52.2	80
2	PCB near Q4	80.2	76.4	82.4	130
3	PCB near U4	73.9	76.9	75.6	130
4	PCB near U5	76.4	67.6	78.7	130
5	PCB near U2	61.8	51.7	63.2	130
6	PCB near D2	65.2	55.3	66.6	130
7	PCB near Q9	77.1	56.3	77.9	130
8	Battery body	61.7	64.6	63.5	Ref
9	Battery output wire	47.4	54.8	50.4	80
10	Motor body	42.1	45.2	50.1	80
11	Enclosure near	57.8	59.7	61.2	Ref
12	Enclosure near	53.4	54.6	55.5	65
13	Button	44.4	43.8	46.7	65

53 Push-Back Strain Relief Test N/A

Method:

53.1 A product with a non-detachable cord is to be tested in accordance with 53.2 without occurrence of any of the conditions specified in 13.2.2.

53.2 The supply cord or lead is to be held 1 in (25.4 mm) from the point where the cord or lead emerges from the product and is then to be pushed back into the product. When a removable bushing which extends further than 1 in is present, it is to be removed prior to the test. When the bushing is an integral part of the cord, then the test is to be carried out by holding the bushing. The cord or lead is to be pushed back into the product in 1-inch increments until the cord buckles or the force to push the cord into the product exceeds 6 lbf (26.7 N). The supply cord or lead within the product is to be manipulated to determine compliance with 13.2.2.

Test Result:

Parts that can cause an injury to persons (did / did not) worked loose.

Conclusion

These results (complied / did not comply) with the requirements.

54 Abnormal Operation Test

54.1 If a product employs a semiconductor or one or more semiconductor junctions, a capacitor, or a combination of both, a risk of fire or electric shock shall not result when either the semiconductor junction or the capacitor is short- or open-circuited.

54.2 In a test to determine whether a product complies with 54.1, the product is to be connected to a grounded supply of rated frequency and maximum rated voltage operating at no load with the short- or open-circuited condition introduced. Only one abnormal condition is to be simulated at a time.

54.3 During the tests described in 54.2, the product is to be connected in series with a nontime-delay fuse representative of the maximum current that could be passed in the circuit by the branch circuit protective device. The maximum current rating shall be based on the maximum current rating that can be accommodated by the fuseholder of the branch circuit to which the product could properly be connected, in accordance with the National Electrical Code, ANSI/NFPA 70.

54.4 Exposed dead metal parts of the product are to be connected to ground through a 3-A fuse, and the test is to be continued until ultimate results are obtained. The results are unacceptable if the fuse opens during the test. If the product is provided with a momentary-contact switch having no provision for being locked on, and if there is indication of malfunction of the product such as emission of smoke, failure to operate in the intended manner, or other indication, the test is to be discontinued when the malfunction becomes evident.

Component No.	Fault Condition	Supply voltage, (V)	Test time (ms)	Observation
Q4(pin G-S)	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
Q4(pin G-D)	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
Q4(pin S-D)	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
U4(pin 1-6)	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
D2	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
D4	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
C13	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.
R17	SC	DC5V	10mins	Unit shutdown immediately, no damage, no hazard.

Test Result:

Parts that can cause an injury to persons (~~did /~~ did not) worked loose.

Conclusion

These results (complied / ~~did not comply~~) with the requirements.

56 Permanence of Marking Tests

56.1 A marking that is required to be permanent shall be molded, die-stamped, paint-stenciled, stamped or etched metal that is permanently secured, or indelibly stamped lettering on a pressure-sensitive label that complies with the requirements in the Standard for Marking and Labeling Systems, UL 969. Ordinary usage, handling, storage, and the like of a product are considered in the determination of the permanence of a marking.

56.2 Each sample power-supply cord or hose with attached tag is to be tightly suspended and clamped at each end in a vertical plane with the attachment plug on a cord pointing upward. A 5-lb (22.2-N) force is to be applied for 1 min at the uppermost corner of the tag farthest from the cord or hose and within 1/4 in (6.4 mm) of the vertical edge of the tag. The force is to be applied vertically downward in a direction parallel to the major axis of the cord or hose. Following the test, the sample shall comply with the requirements in 56.2. Manipulation of the tag, such as straightening by hand, is permitted.

Test Result:

All markings on the equipment are durable and legible and be easily discernable under normal lighting conditions.

Conclusion

These results (complied / ~~did not comply~~) with the requirements.

57 Vibration Test

57.1 With reference to 36.1.9, a sample pressure vessel assembly is to be placed on a vibration table in its normal upright position and not secured in place. Loose restraint shall be used to limit the area of travel. For an assembly provided with a mounting means intended to support a motor, compressor, or a similar device, a load equal to the maximum load that the tank is to support in normal use shall be secured to the intended mounting surface. The load is to be imposed by the heaviest motor, compressor, controls, and piping that are to be supported by the tank or by weights representing an equivalent load secured in position to simulate the actual construction. An assembly with wheels is to be tested with the wheels in place.

57.2 The test apparatus is to consist of a vibration table that provides continuous circular motion with a total displacement of 1 inch (25.4 mm) in a vertical plane with the table level at all times. The speed of the apparatus is to be adjusted so that the vibration frequency generates a 1/16-in (1.6-mm) vertical displacement of the pressure vessel assembly from the table.

57.3 During the test, the pressure vessel assembly is to be rotated 90 degrees from the initial position so that the sample is subjected to both longitudinal and transverse circular vibration. The sample is to be subjected to vibration in each position for 3-1/2 h – 7 h of total vibration time. After making the change in position of the sample – 90-degree rotation – the speed of the test apparatus is to be readjusted to maintain a 1/16-in (1.6-mm) tank displacement.

Test Result:

Parts that can cause an injury to persons (~~did /~~ did not) worked loose.

Conclusion

These results (complied / ~~did not comply~~) with the requirements.

Pictures

Figure 1(For model: HZ009)

Figure 2 (For model: HZ009)

Pictures

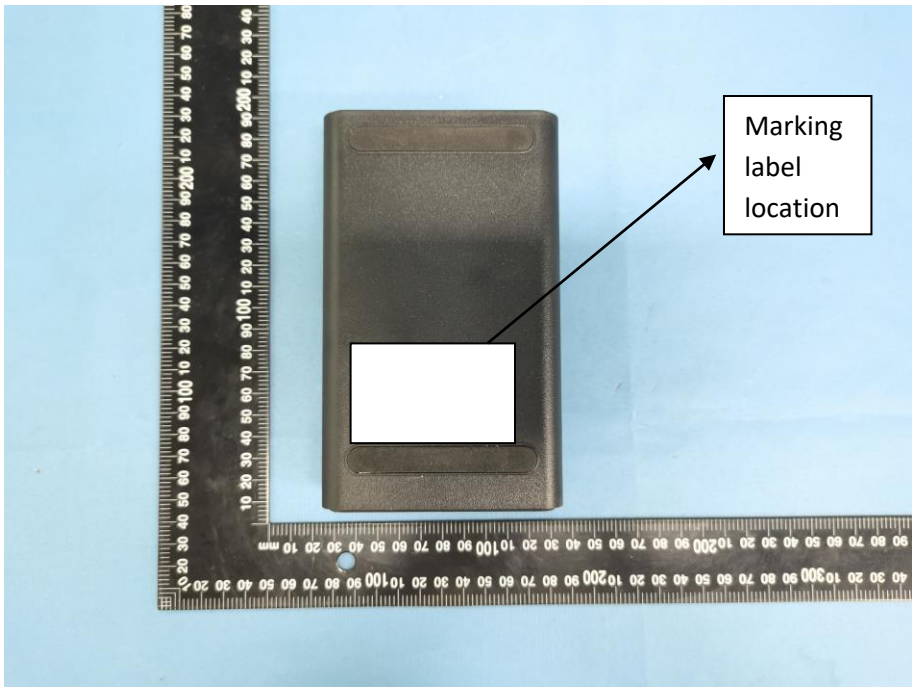


Figure 3 (For model: HZ009)

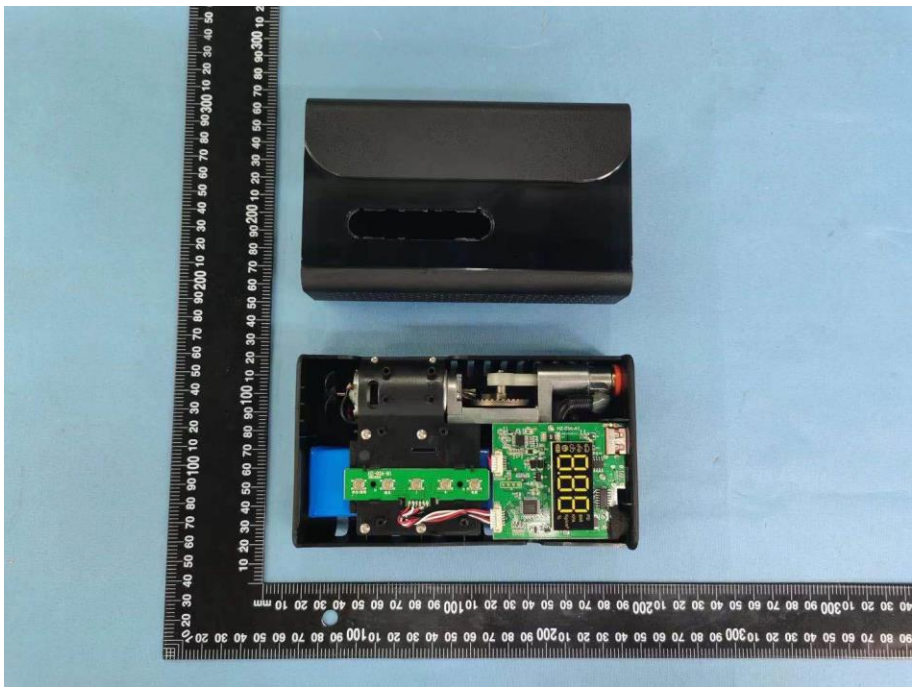


Figure 4 (For model: HZ009)

Pictures

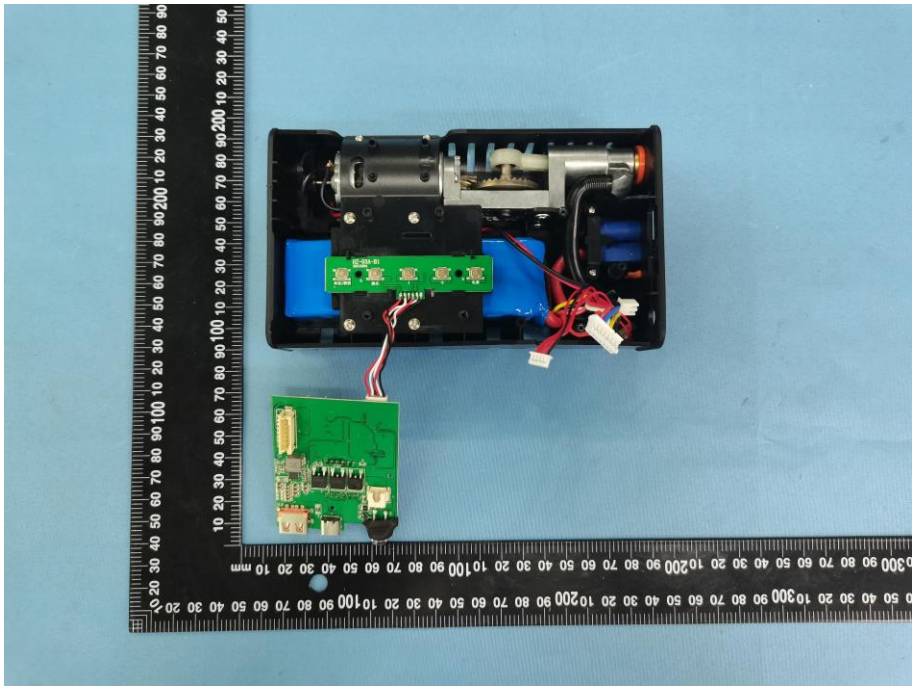


Figure 5 (For model: HZ009)

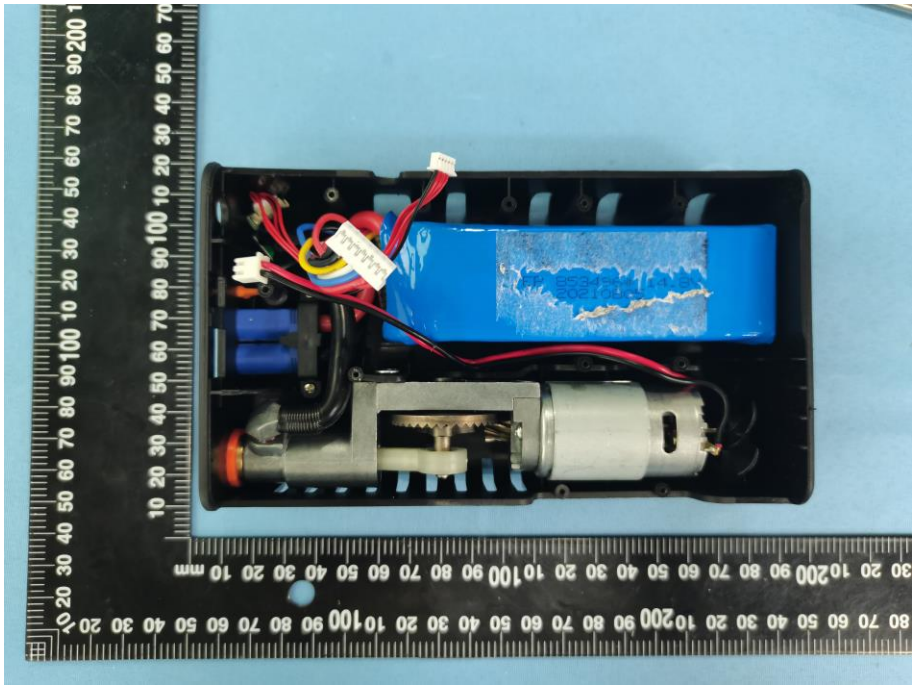


Figure 6 (For model: HZ009)

Pictures

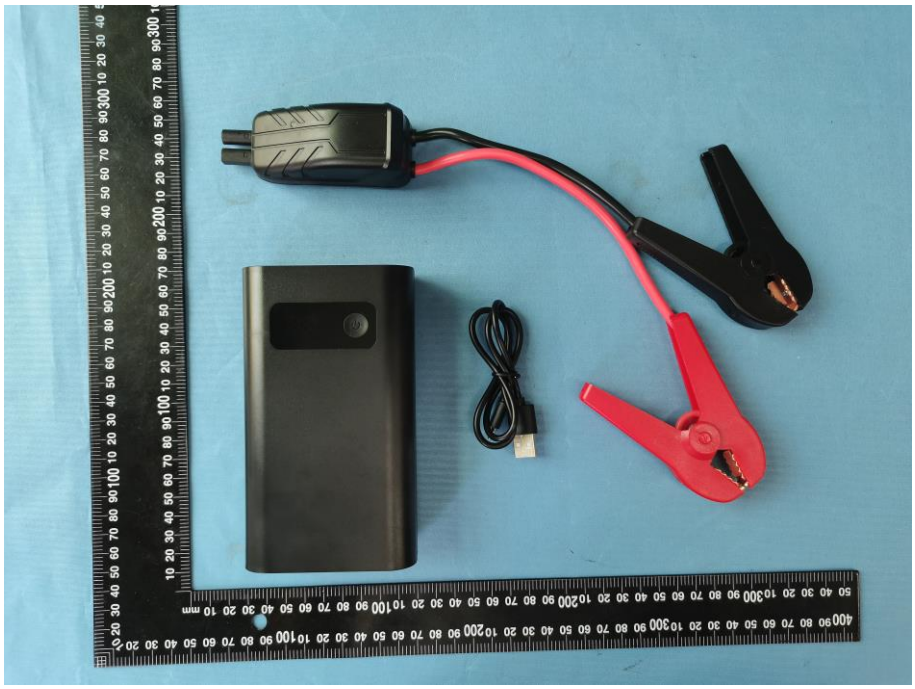


Figure 7 (For model: HZ014)

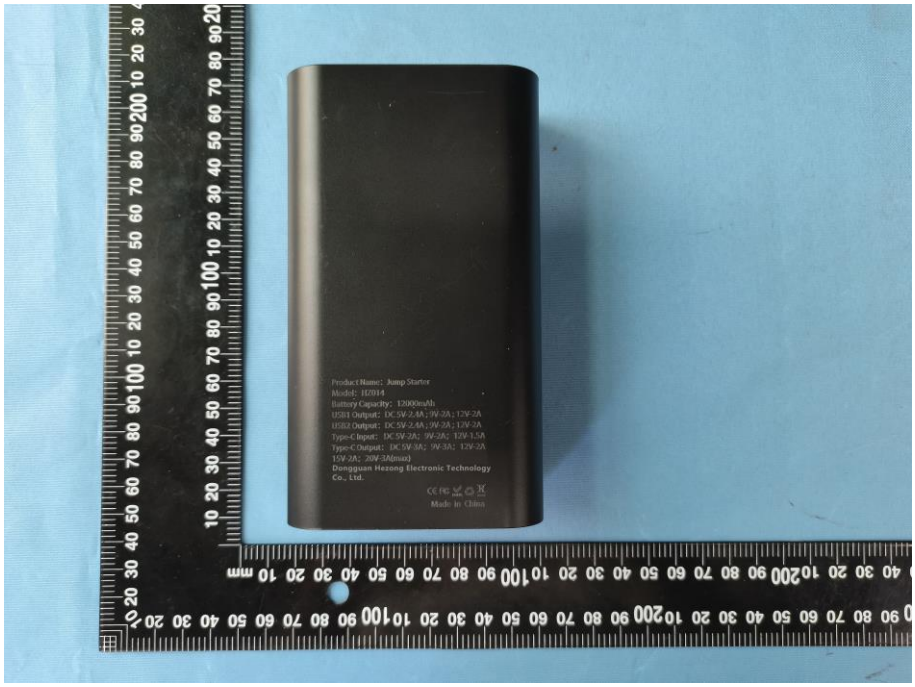


Figure 8 (For model: HZ014)

Pictures

Figure 9 (For model: HZ014)

********** The End of Report **********