TEST REPORT
CAN/UL 2743: 2020
Portable Power Packs

Report Number .....:	LCSA022323027S
Date of issue.....:	2023-03-28
Total number of pages .....:	84
Testing Laboratory Name .....:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address .....:	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Applicant's name.....:	Shenzhen Wodefeng Technology Co. , Ltd.
Address .....:	Room D001, Zone D, Floor 3, Science and Technology Incubation Center, Gangzhilong Science Park, No. 6, Qinglong Road, Qinghua Community, Longhua Street, Longhua District, Shenzhen
Test specification:	
Standard.....:	CAN/UL 2743: 2020
Test procedure .....:	Type test
Non-standard test method.....:	N/A
Test Report Form No.....:	N/A
Test Report Form(s) Originator .....:	TÜV Rheinland (Shenzhen) Co., Ltd.
Master TRF.....:	ANSI/CAN/UL 2743_2020A
Test Item description .....:	Portable Power Station
Trade Mark	/
Manufacturer	Same as the Applicant
Model/Type reference	AF-P210
Ratings	See pages 2 label

Prepared by	Kyrie Xu Project Handler	
Checked by.....	Terry Zhu Reviewer	
Approved by	Hart Qiu Technical Director	

List of Attachments (including a total number of pages in each attachment):

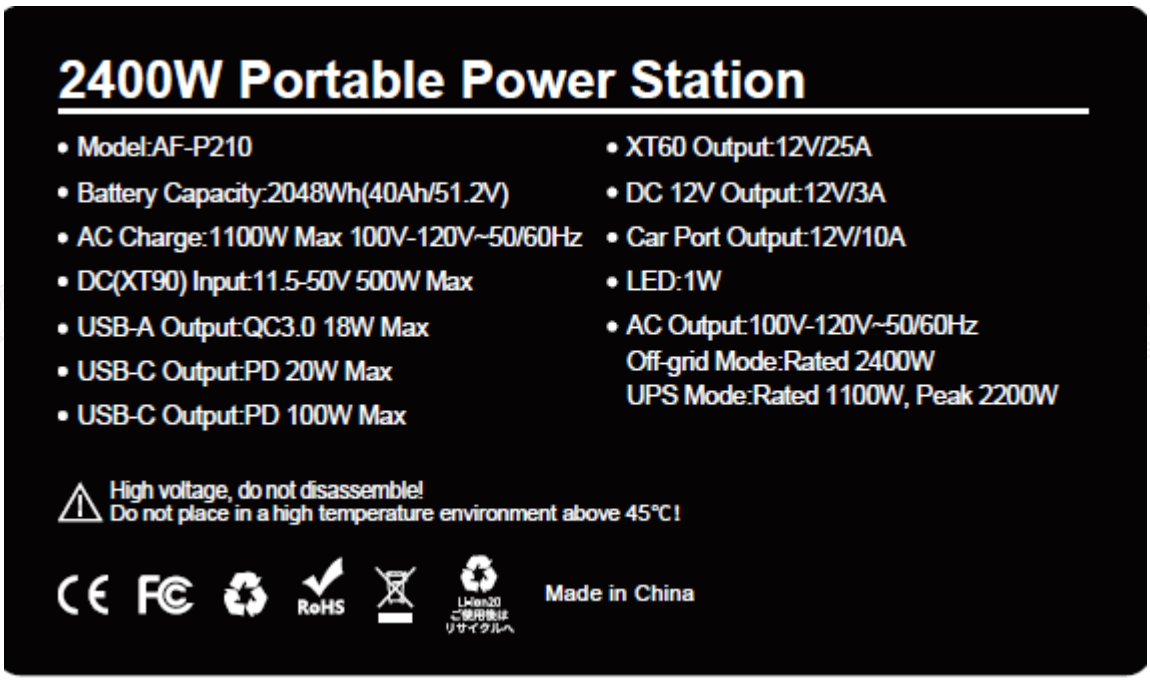
- Attachment 1: Photo Documentation

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All applicable tests are applied. (Detail data see in the separate test record)	Shenzhen LCS Compliance Testing Laboratory Ltd. Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China

Copy of marking plate(s):

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Note:

N/A

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..... :	2023-03-21
Date (s) of performance of tests..... :	2023-03-21 ~ 2023-03-28
General remarks:	
The test result presented in this report relate only to the object(s) 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 point is used as the decimal separator.	

GENERAL PRODUCT INFORMATION:
Product Description: **1. The ambient temperature is 0°C to +40°C.** 2. **Mass of equipment: 20.95kg.**

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Clause	Requirement – Test	Result – Remark	Verdict
	CONSTRCUTION		
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.	Misuse of the product was be considered	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 70.18. Power packs that are not intended for use in a repair facility shall be marked in accordance with 70.19.	Not intended for use within a repair facility	P
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 70.19 and 70.20, and shall be provided with instructions in accordance with 74.5. Indoor use only power packs shall be marked in accordance with 70.21 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.	Temporary outdoor use	P
6.4	For power packs not marked in accordance with 70.22, the device shall be subjected to the Vibration Test, Section 51.		N/A
7	**Frame and Enclosure**		P
7.1	General		P
7.1.1	An enclosure of a power pack shall be formed and assembled so that it has the strength and rigidity necessary to resist the abuses to which it may be subjected, without increasing the risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.		P
7.1.2	A power pack shall be provided with an enclosure suitable for the application. The enclosure shall house all live parts that may increase the risk of fire, electric shock, or injury to persons under any condition of use. This requirement does not apply to the power supply cord, the output leads, or output terminals.		P
7.1.3	If an electrical instrument, such as a meter, forms part of the enclosure, the face or the back of the meter, or both together, shall comply with the requirements for enclosures.	No such parts	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
7.1.4	The enclosure for a power pack provided with an internal lead acid battery shall be ventilated to permit dispersion of gases from the internal battery during normal use and charging. See 7.4.	Lithium ion battery used	N/A
7.1.5	Enclosures for power packs shall comply with the requirements for environmental considerations in 7.5.		P
7.2	**Metallic enclosures**	Plastic enclosure	N/A
7.2.1	Enclosures constructed of metallic materials shall be subjected to the Strength of Enclosure Tests, Section 55		N/A
7.2.2	A metallic enclosure shall have a thickness not less than that specified in Tables 7.1 and 7.2		N/A
7.2.3	Metallic enclosures, if not constructed of a material that is corrosion resistant, shall be provided with corrosion protection in accordance with Corrosion Protection, Section 10.		N/A
7.3	Nonmetallic enclosures	Plastic enclosure	P
7.3.1	In addition to the performance tests specified in this Standard, the factors to be considered when evaluating the suitability of a polymeric enclosure include the requirements in 7.3.2 through 7.3.4.		P
7.3.2	The enclosure material shall have a minimum flame rating of V-1 in accordance with 8.1.	V-0	P
7.3.3	The enclosure material shall have a minimum Relative Thermal Index (RTI) value that exceeds the maximum temperature observed on the material during operation but no less than 80°C (176°F) for packs intended to be stored in the trunk or passenger compartment of a vehicle. If an RTI value that exceeds the maximum temperature observed on the material during operation, but is lower than 80°C (176°F), is used, the power pack shall be marked in accordance with 70.22 and provided with instructions as shown in 74.7.	RTI: 85°C	P
7.3.4	A conductive coating applied to a nonmetallic surface such as the inside surface of an enclosure, shall be evaluated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17, unless it can be determined that flaking or peeling of the coating does not result in a reduction of spacings or the bridging of live parts that may result in a risk of fire, electric shock, or injury to persons.	Enclosure comply with UL 746C and CAN/CSA C22.2 No.0.17	P
7.3.5	An adhesive used to secure parts of an enclosure shall comply with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17.		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.6	Enclosures of molded or formed nonmetallic materials shall be constructed so that any shrinkage or distortion of the material over time will not allow for the user to contact live parts at hazardous voltage or hazardous energy levels. Compliance is determined by the Mold Stress Test, Section 56.		P
7.3.7	Enclosures constructed of nonmetallic materials shall be subjected to the Strength of Enclosur Tests, Section 55.		P
7.4	Openings in enclosures		P
7.4.1	Power pack enclosures shall not allow the entrance of water in accordance with 7.5		P
7.4.2	A probe as illustrated in Figure 7.1, when inserted through an opening, shall not touch any uninsulated live part that can cause electric shock		P
7.4.3	Thermoplastic covering an opening for user servicing, such as replacement of a pilot lamp, and that reduces the risk of unintentional contact with a live part involving a risk of electric shock shall be evaluated as an enclosure It shall be reliably retained in place	No user servicing parts	N/A
7.4.4	An uninsulated live part at hazardous voltage or hazardous energy levels shall be located or enclosed so that protection against unintentional contact is provided.		N/A
7.4.5	A door or cover that provides access to a live part at hazardous voltage or hazardous energy levels shall be securely held in place so that it can be opened or removed only by using a tool	Hazardous voltage or hazardous energy can not directly accessible	N/A
	Exception: A door or cover that provides access to a live part that is not at hazardous voltage or hazardous energy levels shall be securely held in place, but need not be secured so that it is necessary to use a tool to open or remove it		P
7.4.6	The door or cover of an enclosure shall be hinged or attached in an equivalent manner if it provides access to an overload-protective device, the functioning of which requires renewal, or if it is necessary to open the cover in connection with the operation of the protective device. A door or cover providing access to a fuseholder shall be tight-fitting and shall be positively held closed		N/A
	Exception: A hinged cover is not required if the only overload-protective devices enclosed are:		N/A
	a) Connected in control circuits, provided the protective devices and the circuit loads are within the same enclosure;		N/A
	b) Rated 2 amperes or less for loads not exceeding 100 volt-amperes;		N/A
	c) Extractor fuses having an integral enclosure; or		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	d) Fuses connected in a low-voltage limited energy circuit.		N/A
7.4.7	The operating handle of a circuit breaker, an operating button of a manually operable protector, the capped portion of an extractor-type fuseholder, or a similar part may project outside the enclosure.	No such parts	N/A
7.5	Environmental considerations		P
7.5.1	The enclosure of an outdoor use or temporary outdoor use power pack shall be constructed to exclude a beating rain in accordance with 7.5.2.		P
7.5.2	All outdoor use or temporary outdoor use power packs shall be subjected to the Rain Test, Section 60.	See section 60	P
7.5.3	A gasket employed in a power pack in order to comply with 7.5.1 shall be tested in accordance with Accelerated Aging of Gaskets, Sealing Compounds, and Adhesives, Section 62.	No such parts	N/A
7.5.4	A nonmetallic enclosure for an outdoor use power pack shall be judged on the basis of the effect of exposure to ultraviolet light and water in accordance with the applicable tests in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17. Temporary outdoor use power packs need not comply with this requirement.		P
8	**Flammability of materials**		P
8.1	Nonmetallic materials used for enclosures shall have a minimum flammability rating of V-1 in accordance with the requirements in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17. As an alternative, finished enclosures may be tested in accordance with the 20 mm end-product flame test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17. Metallic materials used for enclosures are considered to comply without further evaluation, except magnesium shall not be used for enclosure materials.	The V-0 fire enclosure is used.	P
8.2	Nonmetallic materials used for internal parts within the overall enclosure shall be rated V-2 minimum	Internal parts within the overall enclosure rated V-2 minimum.	P
	Exception No. 1: The internal insulating system of components where component requirements exist need not comply with this requirement		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Exception No. 2: A small part, gasket, or other nonmetallic part that is located such that it cannot propagate flame from one area to another within the equipment, and is not located in close proximity to uninsulated live parts, is not required to comply with this requirement		P
8.3	Nonmetallic materials located outside the enclosure, and not used to complete the enclosure, are considered decorative parts. These parts shall be rated HB minimum.	No such decorative parts.	N/A
8.4	Printed wiring board materials shall be rated V-1 minimum.	V-0 PCB used.	P
8.5	For the requirements outlined in 8.2 – 8.4, the flammability rating of the material shall be provided as part of the material rating or the flammability rating may be determined in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17.	Enclosure complied with UL94 and CAN/CSA C22.2 No.0.17	P
9	**Assembly**		P
9.1	An uninsulated live part shall be secured to the base or surface so that it is prevented from rotating or shifting in position as the result of normal stresses, if such movement results in a reduction of spacings below the minimum values indicated in Spacings, Section 29.	No such part.	N/A
9.2	A component such as a control switch, lampholder, or connector, shall be mounted securely and shall be prevented from turning by means other than friction between surfaces.	The components be mounted securely and not be rolated.	P
9.3	With reference to 9.2, a switch is not required to be mounted as described in 9.2, if all of the following conditions are met:		N/A
	a) The switch is a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch;		N/A
	b) The means for mounting the switch makes it unlikely that operation of the switch will loosen it;		N/A
	c) Spacings are not reduced below the minimum values indicated in Spacings, Section 29, if the switch rotates; and		N/A
	d) Operation of the switch is by mechanical means rather than by direct contact by persons.		N/A
9.4	With reference to 9.2, a lampholder of the type in which the lamp cannot be replaced, such as a sealed neon pilot or indicator light, is not required to be mounted in accordance with 9.2, if rotation cannot reduce spacings below the minimum values indicated in Spacings, Section 29	No such parts	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
9.5	A small stem mounted device having a single hole mounting means may be prevented from rotating by a properly applied lock washer		N/A
10	**Corrosion protection**	No such parts	N/A
11	**Supply connections**		P
11.1	General		P
11.1.1	Power packs are intended to be connected to the power supply circuit in order to recharge the internal battery, electrochemical capacitors, or electrochemical capacitor modules. Additionally, outputs of the power pack may be powered when the pack is connected to the supply circuit.		P
11.1.2	Power packs shall be provided with one or more of the following input options:	See clause 11.3	P
	a) Cord and plug connection, rated at 240 V ac maximum, 60 Hz;	A approval adapter is used	P
	b) Photovoltaic panel or device with inverter;		N/A
	c) Vehicle adapter, rated 12 V dc maximum;		N/A
	d) USB input port (can also act as output port); or		N/A
	e) Cables for charging from a vehicle battery rated up to 24 V dc maximum.		N/A
11.2	Flexible cord connection	Not flexible cord connection	N/A
11.2.1	General		N/A
11.2.1.1	For flexible cord connections, the power pack shall be connected to the power supply circuit by means of a flexible cord and an attachment plug. The flexible power cord shall be either a detachable or non-detachable type. For devices intended for use with a detachable cord set, the cord set need not be provided with the device when the power pack is marked in accordance with 70.17 and the instructions are in accordance with 73.2.		N/A
11.2.1.2	For power packs intended for use in a repair facility, a detachable flexible cord shall be provided with a means to insure that the flexible cord cannot be inadvertently detached during use		N/A
	Exception: A device intended for use in a repair facility that is provided with a means to insure that the appliance inlet on the device is inherently located at a height above 457 mm (18 inches) may also be provided with a detachable cord set without a means to insure inadvertent detachment, when the power pack is marked in accordance with 70.17 and the instructions are in accordance with 73.2.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
11.2.1.3	A flexible cord shall have a voltage rating not less than the rated voltage of the equipment, and shall have an ampacity not less than the current rating of the equipment		N/A
11.2.1.4	The attachment plug shall have an ampacity not less than the rated current of the product or the actual current measured during the Power Input Test, Section 42, whichever is greater, and a voltage rating equal to the rated voltage of the product. If a product is adaptable for use on two or more different values of voltage by field alteration of internal connections, the attachment plug provided with the product shall be rated for the voltage for which the product is connected when leaving the factory		N/A
11.2.1.5	A flexible cord shall be Type G, SO, SJO, SJEO, SJTO, STO, or W, or a type at least equally serviceable for the particular application		N/A
11.2.1.6	The length of a flexible cord, including the attachment plug, shall not be less than 6 feet (1.8 m).		N/A
11.2.1.7	If a product incorporates a disconnecting means, such as an appliance inlet, the arrangement shall be such that no live parts will be exposed under any normal conditions		N/A
11.2.1.8	A permanently attached flexible cord shall exit the enclosure in an area that is not in close proximity to a hot spot or moving part		N/A
11.2.2	Strain Relief		N/A
11.2.2.1	Strain relief shall be provided on a non-detachable flexible cord to reduce the risk of mechanical stress being transmitted to terminals, splices, or interior wiring. See Strain Relief Test, Section 54. A knot in the flexible cord is not considered a form of strain relief.		N/A
11.2.2.2	A metal strain relief clamp or band provided in accordance with 11.2.2.1 shall be provided with auxiliary insulation over the cord if damage to the cord insulation results when the strain relief test is conducted without auxiliary insulation		N/A
11.2.2.3	Means shall be provided to prevent a flexible cord from being pushed into the equipment through the cord entry hole if such displacement would:		N/A
	a) Result in mechanical damage to the cord;		N/A
	b) Expose the cord to a temperature than that for which it is rated; or		N/A
	c) Reduce spacings, such as to a metal strain relief clamp, below the minimum values indicated in Spacings, Section 29.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	To determine compliance, the flexible cord shall be tested in accordance with the Push-Back Strain Relief Test, Section 54.2.		N/A
11.2.3	Bushings		N/A
11.2.3.1	At the point where a non-detachable flexible cord passes through an opening in the enclosure, there shall be a bushing or the equivalent that is secured in place, and that has a smooth, well rounded surface against which the cord may bear. An insulating bushing shall be provided, if the enclosure is of metal, or if the construction is such that the cord may be subjected to strain or motion. A bushing that complies with the applicable requirements in the Standard for Insulating Bushings, UL 635, is considered to comply with this requirement		N/A
11.2.3.2	A hole in porcelain, phenolic composition, or other non-conducting material, having a smooth, rounded surface, is considered to be equivalent to a bushing		N/A
11.2.3.3	A bushing of the same material as, and molded integrally with, a supply cord is acceptable if the built-up section is not less than 1/16 inch (1.6 mm) thick at the point where the flexible cord passes through the enclosure.		N/A
11.2.3.4	At a point of flexure, no additional flexible cords or wires shall be routed through a bushing or opening with the power supply cord.		N/A
11.3	External power supplies	A approval adapter is used	P
11.3.1	As an alternative to flexible cord connections, the power pack may be provided with a DC voltage rated input connector intended for connection to the output of an external power supply		P
11.3.2	The output rating of the external power supply shall be equal to or greater than the input rating of the power pack; and the output of the external power supply shall be a power source in accordance with the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 and CAN/CSA C22.2 No. 60950-1, a Class 2 power source in accordance with the Standard for Class 2 Power Units, UL 1310, and Power Supplies With Extra Low Voltage Class 2 Outputs – General Instruction No. 1, CAN/CSA C22.2 No. 223, or a power source other than Class 2 in accordance with the Standard for Power Units Other Than Class 2, UL 1012, and CSA-C22.2 No. 107.2-01.		P
11.4	Vehicle adapters	Comply with UL 2089	P

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Clause	Requirement – Test	Result – Remark	Verdict
11.4.1	A power pack intended for connection to an automobile cigar lighter receptacle shall be provided with a vehicle adapter that complies with the enclosure and input contacts requirements in the Standard for Vehicle Battery Adapters, UL 2089, and Power Supplies, CAN/CSA C22.2 No. 107.1. The connector plug shall incorporate a fuse or other protective device having a current rating not greater than 15 A.		N/A
	Exception: The protective device may be provided in the output cord of the vehicle adapter not more than 5 inches (127 mm) from the vehicle adapter enclosure		N/A
11.4.2	With reference to 11.4.1, if the fuse is user replaceable, the vehicle adapter shall be marked in accordance with 70.10. This marking shall appear adjacent to the fuseholder		N/A
11.5	Photovoltaic panels		N/A
11.5.1	Power packs provided with a photovoltaic panel as an input for charging the internal battery shall be provided with an inverter and/or a charge controller and shall be in accordance with the applicable requirements in the Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741; or with the applicable requirements in the Standard for Power Converters for Use in Photovoltaic Power Systems – Part 1: General Requirements, UL 62109-1.		N/A
12	**Output connections**		P
12.1	General		P
12.1.1	Power packs shall be provided with one or more outputs that terminate in a suitable connector or other connection means in accordance with the requirements in this Standard.		P
12.1.2	The output of the power pack shall include at least one of the output options shown in (a) – (d). Additional outputs are not restricted.		P
	a) Booster cable assemblies, see 12.2;		N/A
	b) Receptacles, see 12.3;		P
	c) DC Connectors, see 12.4;	DC ports used.	P
	d) Vehicle adapter sockets, see 12.5;		P
	e) USB Connectors, see 12.4.	USB ports used.	P
12.2	Booster cables assemblies		N/A
12.2.1	General		N/A
12.2.1.1	Booster cable assemblies shall be detachable or non-detachable assemblies. Detachable assemblies shall comply with 12.2.1.2 and the applicable requirements in 12.2.2 and 12.2.3. Non-detachable assemblies shall comply with 12.2.1.3 and the applicable requirements in 12.2.2 and 12.2.3.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
12.2.1.2	For detachable booster cable assemblies, the connector shall be in accordance with the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977, and Special Use Attachment Plugs, Receptacles and Connectors, CAN/CSA C22.2 No. 182.3, or the connector shall be in accordance with the Standard for Automotive Battery Booster Cables, UL 1839 (middle connectors). The connector shall have a voltage and current rating that is the same as or higher than the output rating of the booster cable assembly.		N/A
12.2.1.3	For non-detachable booster cable assemblies, the cable shall be provided with strain relief in accordance with Section 11.2.2 and bushings shall be provided in accordance with Section 11.2.3.		N/A
12.2.2	Cables		N/A
12.2.2.1	The cable provided with the booster cable assembly shall comply with the applicable requirements for cables in the Standard for Automotive Battery Booster Cables, UL 1839		N/A
12.2.2.2	As an alternative to 12.2.2.1, the cable can be shown to comply with the requirements in 12.2.2.3 – 12.2.2.7, when the power pack is provided with a protection system for the cable assembly. The protection system shall provide output limiting such that a maximum current cannot be exceeded under normal or abnormal conditions and the maximum temperature of the cable insulation shall not be exceeded during the Normal Temperature Test, Section 47.		N/A
12.2.2.3	The conductors used within the cables shall:		N/A
	a) Comply with the requirements in the Standard for Appliance Wiring Material, UL 758, and either Equipment and Lead Wires, CAN/CSA C22.2 No. 127, or Appliance Wiring Material Products, CAN/CSA C22.2 No. 210; and		N/A
	b) Be suitably sized based on the rating of the output current associated with the booster function.		N/A
12.2.2.4	The final cable assembly shall be subjected to the Cold Bend Test, Section 67.		N/A
12.2.2.5	At all points where the cable enters the enclosure of the device or any other enclosure, excluding the cable connection to the clamp, the connection shall be subjected to a strain relief test as described in Section 54.		N/A

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12.2.2.6	The conductors of a booster cable set employing parallel conductors shall be separated at each end to allow the jaw ends of the clamps to span a minimum distance of 920 mm (3 feet). For power packs provided with a safety circuit that prevents energy from being available at the booster clamps prior to connection and immediately upon disconnection, such that arcing and sparking is prevented at the battery terminals, the 920-mm minimum distance can be reduced. The safety circuit shall be subject to the requirements in Section 40, Safety Circuits and Control Circuits.		N/A
12.2.2.7	The cable shall be subjected to the Ampacity Test in Section 65		N/A
12.2.3	Clamps		N/A
12.2.3.1	The clamp provided with the booster cable assembly shall comply with the applicable requirements for clamps in the Standard for Automotive Battery Booster Cables, UL 1839		N/A
12.2.3.2	As an alternative to 12.2.3.1, the cable can be shown to comply with the requirements in 12.2.3.3 – 12.2.3.6, when the power pack is provided with a protection system for the cable assembly. The protection system shall provide output limiting such that a maximum current cannot be exceeded under normal or abnormal conditions and the maximum temperature of the cable insulation shall not be exceeded during the Normal Temperature Test, Section 47		N/A
12.2.3.3	The clamp bodies shall be fabricated from nonmetallic materials and these materials shall have a flame rating of HB minimum		N/A
12.2.3.4	The clamps shall be subjected to the Cold Drop Test using a conditioning temperature equal to the manufacturer's lower ambient temperature rating. See 68.2.		N/A
12.2.3.5	The clamps shall be subjected to the Dielectric voltage-withstand test, Section 68.3		P
12.2.3.6	The clamp shall be subjected to the Secureness test , Section 68.4		N/A
12.3	Receptacles	Approved receptacles used.	P
12.3.1	Receptacles provided as an output on power packs shall be rated 120 Vac, 20 A maximum, and shall consist of a double blade, ungrounded configuration, and shall be of a NEMA type receptacle that is in accordance with the Standard for Attachment Plugs and Receptacles, UL 498, and General Use Receptacles, Attachment Plugs and Similar Wiring Devices, CAN/CSA C22.2 No. 42.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Exception: Polarized receptacles rated 120 Vac, 20 A maximum, and consist of grounding configuration may be acceptable provided the power source (integrated battery pack, etc) has no conductive connections to AC output circuit or any other branch circuit, and potential involving risk of electrical shock shall not exist between ground and the grounded circuit contact, terminal, or lead. Compliance shall be checked by inspection and by neutral-to-ground potential and leakage current measurement. The potential shall not exceed 42.4 Vpk at no-load and full-load conditions, or the leakage current determined in accordance with Section 46, Leakage Current Test, shall not exceed 0.5 mA.		P
12.3.2	Markings shall be provided that indicate the maximum rating of the receptacle to the user. This marking shall be permanent	See label	P
12.4	DC output connectors and USB connectors		P
12.4.1	Power packs provided with USB connections as an output shall incorporate connectors that are in accordance with the Standard for Component Connectors for Use in Data, Signal, Control, and Power Applications, UL 1977, and Special Use Attachment Plugs, Receptacles and Connectors, CAN/CSA C22.2 No. 182.3.	See below clause 12.4.3	N/A
12.4.2	DC output connectors provided as an output shall incorporate connectors that are in accordance with the Standard for Component Connectors for Use in Data, Signal, Control, and Power Applications, UL 1977, and Special Use Attachment Plugs, Receptacles and Connectors, CAN/CSA C22.2 No. 182.3.		N/A
12.4.3	A circuit supplied by a single source of supply, consisting of a battery or power supply with an isolating transformer, need not be investigated if:		P
	a) The open circuit potential or no-load output of the source is not more than 30 volts DC or 21.2 volts peak;		P
	b) The current available to the circuit is limited so that the current under any condition of load, including short circuit, is not more than 8 amperes; and		P
	c) The power available is not more than 240 VA.		P
12.5	Vehicle adapter sockets		P
12.5.1	Adapter sockets provided as an output on a power pack, for connecting products with a standardized vehicle adapter connector, shall comply with 12.5.2		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
12.5.2	The cable, if provided, shall be suitable for the voltage and ampacity of the output rating. The cable shall be in accordance with the Standard for Appliance Wiring Materials, UL 758, and either Equipment and Lead wires, CAN/CSA C22.2 No. 127, or Appliance Wiring Material Products, CAN/CSA C22.2 No. 210.		P
12.5.3	A circuit supplied by a single source of supply, consisting of a battery or power supply with an isolating transformer, need not be investigated if:		N/A
	a) The open circuit potential or no-load output of the source is not more than 30 volts DC or 21.2 volts peak;		N/A
	b) The current available to the circuit is limited so that the current under any condition of load, including short circuit, is not more than 8 amperes; and		N/A
	c) The power available is not more than 240 VA		N/A
13	**Grounding**	No grounding	N/A
13.1	General		N/A
13.1.1	A product shall have a provision for grounding in accordance with 13.1.2 – 13.2.2 that is reliably connected when the unit is connected to the mains power source. The means for grounding may be contained within a separate or integral power supply that has been shown to comply with the applicable requirements for power supplies. In this case, no further evaluation of grounding is needed		N/A
	Exception: Double insulated products are not required to comply with Section 13. See Double Insulated Products, Section 14		N/A
13.1.2	All exposed dead metal parts, that are likely to become energized, shall be reliably connected to the means for grounding.		N/A
13.1.3	The equipment grounding conductor of the power supply cord may be used for grounding		N/A
13.1.4	The grounding conductor of a supply cord shall be secured to the metallic enclosure of the product by means of a separate screw or other equivalent means, intended for that purpose only, that is not likely to be removed during any servicing operation not involving the power supply cord. Solder alone shall not be used for securing the grounding conductor. Servicing as mentioned in this requirement include repair of the product by a qualified service person.		N/A
	Exception: Products with no exposed dead metal parts need not comply with 13.1.4.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
13.1.5	The grounding conductor and the dead metal parts shall be conductively connected to the grounding member of an attachment plug. The grounding member shall be fixed.		N/A
13.1.6	A separable connection, such as that provided by an attachment plug and a mating connector or receptacle, shall be such that the equipment grounding connection is made before and broken after the supply conductors		N/A
13.1.7	The grounding terminal, intended solely for the connection of an equipment grounding conductor, shall be capable of securing a conductor of the size necessary for the application. A connection device that depends on solder alone shall not be provided for connecting the equipment grounding conductor		N/A
13.1.8	A wire binding screw or pressure wire connector intended for the connection of an equipment grounding conductor shall be located so that it is unlikely to be removed during servicing of the power pack.		N/A
13.1.9	A screw used to secure the grounding conductor to the frame shall engage the metal by at least two full threads. The metal thickness shall not be less than 0.050 inch (1.27 mm) thick. The metal may be extruded to increase the effective thickness. Only the supply cord grounding conductor shall be secured by the grounding screw.		N/A
13.1.10	A stud and nut combination used to secure the grounding conductor to the frame shall be secured to the frame by welding the stud in place. The ground conductor shall be connected first and be in contact with the frame and secured in place by a dedicated nut and lock washer. Other bonding jumpers may be connected to the stud, but they shall be connected above the main ground connection and secured by separate nut and lock washers		N/A
13.1.11	With reference to the requirement in 13.1.2, the following dead metal parts are not considered likely to become energized:		N/A
	a) A small metal part, such as an adhesive attached foil marking, a screw, a handle, and the like, that is:		N/A
	1) On the exterior of the enclosure and separated from all electrical components by grounded metal, or 2) Electrically isolated from all electrical components.		N/A
	b) A panel, cover, or other metal part that is isolated from all electrical components by a barrier of vulcanized fiber, varnished cloth, phenolic composition, or other moisture resistant insulating material not less than 1/32 inch (0.80 mm) thick and securely mounted in place, and		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	c) A panel, cover, or other metal part that does not enclose uninsulated live parts and is electrically isolated from other electrical components.		N/A
13.1.12	The main grounding path shall not include a trace on a printed wiring board.		N/A
13.2	Grounding identification		N/A
13.2.1	The surface of the insulation on a grounding conductor of a flexible cord shall be green with or without one or more yellow stripes, and no other lead shall be so identified		N/A
13.2.2	The unit shall be marked at the point of grounding connection to the enclosure or frame with the Symbol ⏚ (IEC 60417 No.5019).		N/A
14	**Double insulated products**	No risk of electric shock	N/A
14.1	A device may be provided with a system of double insulation that complies with the requirements in the Standard for Double Insulation Systems for Use in Electrical Equipment, UL 1097, in lieu of a means for grounding.	Comply with double insulation	N/A
14.2	In addition to complying with 14.1, the system of double insulation shall comply with the requirements in this outline		N/A
14.3	A product shall be marked as being a suitable double insulated product, see Figure 14.1. All such products shall not be provided with a means for grounding		N/A
15	**Current Carrying Parts**		P
15.1	A current carrying part shall be of silver, copper, a copper alloy, stainless steel, or other material suitable for the application. Ordinary unplated iron or steel shall not be used for current carrying parts		P
16	**Internal Wires**		P
16.1	Mechanical protection		P
16.1.1	Wiring and connections between parts of equipment shall be protected or enclosed so that the conductor insulation is not exposed to contact with any rough, sharp, or moving part		P
16.1.2	Insulated wiring accessible through an opening in an enclosure is considered to be protected as required in 16.1.1 if the opening complies with Openings in enclosures, 7.4. Internal wiring not so protected may be acceptable if it is so secured within the enclosure that it is not likely to be subjected to stress or mechanical damage.		N/A
16.1.3	An opening in the frame or enclosure through which insulated wires pass shall be provided with a smooth, well rounded bushing or shall have smooth, well rounded surfaces upon which the wires may lie		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
16.1.4	Insulated wires, complying with the requirements for Separation of Circuits, Section 17, may be bunched and passed through a single smooth opening in a wall within the enclosure		N/A
16.2	Wiring insulation		P
16.2.1	The internal wiring of power packs shall be of a type rated for the application, when considered with respect to the temperature and voltage involved, with respect to its exposure to oil and grease, and with respect to other conditions of service to which it is subjected		P
16.2.2	The insulation of wiring used in a high voltage circuit shall have a flame retardant rating of VW-1in accordance with the requirements in the Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581	No such application	N/A
16.2.3	Sleeving, tape, and tubing used for insulation on wires shall be rated for the voltage and temperature involved		P
16.3	Splices and connections		N/A
16.3.1	Splices and connections shall be mechanically secure and provide electrical contact. A soldered connection shall be made mechanically secure before being soldered		N/A
16.3.2	Equipment subjected to vibration shall be provided with lock washers or other means to mechanically secure wire binding screws and nuts. A twist on type connector shall be additionally secured to the wires by means of at least two layers of tape. Tape used for this means shall be evaluated for its intended application and comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510, and PVC Insulating Tape, CAN/CSA C22.2 No. 197.		N/A
16.3.3	A splice shall be provided with insulation equivalent to that of the wires connected if spacing between the splice and other metal parts is not maintained		N/A
16.3.4	The insulation on a splice may consist of a minimum of two layers of tape when the voltage involved is less than 250 volts. When evaluating the splice insulation consideration is to be given to such factors as its dielectric properties, heat resistance, and moisture resistance. Tape shall not be wrapped over a sharp edge		P

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Clause	Requirement – Test	Result – Remark	Verdict
16.3.5	If internal wiring is stranded, loose strands of wire shall not contact other uninsulated live parts of opposite polarity or dead metal parts. At a wire binding screw, this may be accomplished by using upturned lugs, a cupped washer, barriers, or other means to hold the wires under the head of the screw. Other means of retaining the loose stranded internal wiring in position are use of a pressure terminal connector, soldering lug, or crimped eyelet		P
16.3.6	Aluminum conductors, insulated or uninsulated, used as internal wiring, such as for interconnection between current carrying parts, shall be terminated at each end by a method that is acceptable for the combination of metals involved at the connection point	Not Aluminum conductors	N/A
16.3.7	With reference to 16.3.6, a wire binding screw or a pressure terminal connector used as a terminating device shall be rated for use with aluminum under the condition involved – for example, temperature, heat cycling, vibration, and the like		N/A
16.3.8	Insulation of internal wiring consisting of coated fabric, thermoplastic, or other types of tubing is to be considered with respect to electrical, mechanical, and flammability properties of the material		N/A
17	**Separation of circuits**		P
17.1	Conductors of different circuits operating at different potentials shall be separated or segregated from each other unless each conductor is provided with insulation rated for the highest potential involved		P
17.2	An insulated conductor shall be positioned so that it cannot contact an uninsulated live part of a different circuit		P
17.3	Segregation of insulated conductors may be accomplished by clamping, routing, or a means that maintains permanent separation from insulated and uninsulated live parts and from conductor of a different circuit.		P
17.4	A barrier used to separate or segregate internal wiring shall have the mechanical strength for the application, and it shall be reliably held in place.		P
18	**Insulating Materials**		P
18.1	Insulating materials, used in circuits other than low-voltage, limited-energy circuits, shall be porcelain, phenolic composition, or other similar material, and shall be evaluated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17.	Plastic enclosure comply with UL746C and CAN/CSA C22.2 No. 0.17.	P

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Clause	Requirement – Test	Result – Remark	Verdict
18.2	Ordinary vulcanized fiber may be used for insulating bushings, washers, separators, and barriers, but shall not be used as the sole support for uninsulated live parts if shrinkage, current leakage, or warpage is likely to result in a risk of fire, electric shock, or injury to persons	No such materials used.	N/A
18.3	A thermoplastic material shall not be used for the sole support of live parts unless it complies with all of the following:	Transformer bobbin as sole support of hazardous live parts	P
	a) Mechanical strength;		P
	b) Rigidity;		P
	c) Resistance to heat;		P
	d) Resistance to flame propagation;		P
	e) Dielectric withstand; and		P
	f) Resistance to abnormal heat.		P
19	**Compressors**	No such components.	N/A
19.1	General		N/A
19.1.1	Air compressor assemblies provided with power packs, and housed within the overall power pack enclosure, shall comply with the requirements in 19.2 and 19.3. Air compressors supplied with the power pack, but as a separate unit shall be evaluated in accordance with the Standard for Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment, UL 1450, and Motor Operated Appliances (Household and Commercial), CAN/CSA C22.2 No. 68.		N/A
19.2	Motors and thermal protection		N/A
19.2.1	A motor shall be acceptable for the application, and shall be capable of handling the maximum normal load of the power pack without creating a risk of fire, electric shock, or injury to persons		N/A
19.2.2	A motor winding shall resist the absorption of moisture. Film coated wire used for motor windings is not required to be additionally treated to prevent moisture absorption. Fiber slot liners, cloth coil wraps, and similar moisture absorptive materials are to be provided with impregnation or otherwise treated to prevent moisture absorption		N/A
19.2.3	A motor shall be provided with a thermal protector as described in 19.2.4		N/A
19.2.4	With reference to 19.2.3, thermal protection shall be evaluated in accordance with the Standard for Thermally Protected Motors, UL 1004-3, and Motors With Inherent Overheating Protection, CAN/CSA C22.2 No. 77.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Exception No. 1: A thermally protected motor which drives a fully enclosed oil-less and tankless air compressor, or inflator, evaluated in accordance with the Standard for Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment, UL 1450, and Motor Operated Appliances (Household and Commercial), CAN/CSA C22.2 No. 68.		N/A
	Exception No. 2: A motor intended to move air only, by means of an air moving fan that is integrally attached, keyed, or otherwise fixed to the motor, is required to have locked rotor protection only.		N/A
	Exception No. 3: A linear style pump is required to have locked rotor protection only.		N/A
19.2.5	The thermal protector shall have a current and voltage rating not less than the load that it controls		N/A
19.3	Parts subject to pressure	No such parts	N/A
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**	No such components	N/A
20.1	Capacitors		N/A
20.1.1	A capacitor connected from one side of the line to the enclosure of a product shall have a capacitance rating of not more than 0.10 µF, or the power pack shall be subjected to the Capacitor Discharge Test, Section 45.		N/A
20.1.2	If a product employs a combination consisting of a rectifier and an electrolytic capacitor, no risk of fire, electric shock, or injury to persons shall result when either the rectifier or the capacitor is short-circuited.		N/A
20.1.3	Under both normal and abnormal conditions of use, a capacitor employing a liquid dielectric medium more flammable than askarel shall not expel the dielectric medium when tested in accordance with the performance requirements of this Standard.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
20.2	Electrochemical capacitor modules		N/A
20.2.1	Electrochemical capacitor modules are allowed in power packs to provide the booster cable output. The electrochemical capacitor module shall comply with the requirements in the Standard for Electrochemical Capacitors, UL 810A, as well as the requirements in 20.2.2 – 20.2.4		N/A
20.2.2	Electrochemical capacitor modules shall be provided with a means to monitor the voltage at the input of the module and shall shut down the power to the module if the voltage exceeds the voltage rating of the module. Any appropriate means is allowed, but any software or programmable components associated with this protection means shall be evaluated for reliability		N/A
20.2.3	Electrochemical capacitor modules shall have temperatures of the module continuously monitored during any defined operating condition and the module shall be shut down if the temperature exceed the rated temperature of the module or individual capacitor in the module. Any appropriate means is allowed, but any software or programmable components associated with this protection means shall be evaluated for reliability		N/A
20.2.4	Means shall be provided such that the capacitor module shall not be allowed to discharge while the charging voltage is applied. Any attempt to jump start a vehicle while the power pack is plugged in shall be prohibited by the power pack itself. Any appropriate means is allowed, but any software or programmable components associated with this protection means shall be evaluated for reliability		N/A
21	**Resistors**		N/A
21.1	The assembly of a power resistor, such as a wire wound type requiring a separate support, shall be reliable. The resistor shall be prevented from loosening or rotating by a means other than friction between surfaces.		N/A
21.2	An assembly employing lock washers may be considered to comply with 21.1		N/A
22	**Lampholders**	No lampholders	N/A
22.1	The screw shell of a lampholder shall be connected to a conductor that is intended to be connected to the grounded conductor of the power supply circuit		N/A
22.2	A lampholder shall be designed or installed so that uninsulated live parts, other than a screw shell, are not exposed to inadvertent contact by persons removing or replacing the lamp in normal service		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
22.3	If the lampholder is supplied from an LVLE circuit, the requirements in 22.1 and 22.2 do not apply		N/A
23	**Transformers**		P
23.1	Transformers provided as part of a power pack, shall comply with one of the following:		P
	a) Standard for Specialty Transformers, UL 506;		N/A
	b) Standard for Dry-Type General Purpose and Power Transformers, UL 1561; or		N/A
	c) Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and CAN/CSA C22.2 No. 66.1, and one of the following:		P
	1) Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2 and CAN/CSA C22.2 No. 66.2; or		N/A
	2) Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3 and CAN/CSA C22.2 No. 66.3.		N/A
24	**Switches and Controls**	No such components	N/A
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.		N/A
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.		N/A
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
	Exception: A switch having a tungsten-filament lamp current rating less than the maximum current it will control but rated 3 amperes or more may be used to control a 15-watt or smaller lamp		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
24.6	A switch shall not disconnect the ground conductor of a circuit unless the switch simultaneously disconnects all other conductors.		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
25.1	A printed wiring board shall comply with the requirements in the Standard for Printed Wiring Boards, UL 796, and have a minimum flammability classification of V-1.	V-0, complied with UL 796	P
25.2	A resistor, capacitor, inductor, or other part that is mounted on a printed wiring board to form a printed wiring assembly shall be secured so that it cannot be displaced to cause a risk of fire or electric shock by a force likely to be exerted on it during assembly, normal operation, or servicing of the power pack.		P
25.3	Consideration is to be given to a barrier or partition that is part of the power pack assembly and that provided mechanical protection and electrical insulation for a component connected to a printed wiring board.		P
26	**Interlocks**	No interlocks	N/A
26.1	An interlock required to reduce the risk of electric shock or injury to persons shall comply with 26.2 – 26.6.		N/A
26.2	The interlock device shall not be defeated readily without:		N/A
	a) Damaging the equipment;		N/A
	b) Making wiring connections or alterations;		N/A
	c) Using other than ordinary tools; or		N/A
	d) Using materials other than those readily available. Adhesive tape, string, or conventional extension cord sets are identified as readily available.		N/A
26.3	The interlock device shall be such that during normal operation and user servicing:		N/A
	a) The interlock is not defeated by improper disassembly, for example removal of the wrong screws during removal of the cover;		N/A
	b) The cover in which the interlock is mounted shall not be rotated by its own weight about the interlock axis perpendicular to the cover during any stage of its removal or replacement, if such rotation gives access to a live part, or damages the interlock or cover;		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	c) The act of removal or replacement of the interlocked cover shall not subject the user to unintentional contact with live parts;		N/A
	d) The interlocked cover is not capable of being readily misapplied to result in a risk of electric shock; and		N/A
	e) The equipment is marked in accordance with 70.17.		N/A
26.4	If two momentary contact switches must be operated to energize the power pack, the arrangement shall be spaced from each other and from live parts so that, if the means are operated simultaneously by one individual, contact with live parts shall not occur		N/A
26.5	With reference to 26.3(c), parts that are recessed more than 2-1/2 inches (64 mm) from the edge of the cabinet opening, normally in the plane of the cover, are excluded when determining that the act of removal or replacement of a cover will subject the user to unintentional contact with live parts		N/A
26.6	An interlock shall comply with Overload of Interlocks, Section 53.4		N/A
27	**Overload Protection Devices**		P
27.1	An overcurrent or thermal protective device shall be suitable for the application	Weak part on the connection of betweem internal wire of booster connector and battery	P
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	No such device	N/A
27.3	A fuse involving a risk of electric shock shall be inaccessible:	No such device	N/A
	a) To the user from outside the enclosure, and	No such device	N/A
	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	No such device	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.	No such device	N/A
28	**Internal battery**		P
28.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
28.1.1	Connections to the terminals of the internal battery shall be secure. The connection means shall not allow the connection to loosen during normal operation to the point where the connection is lost, or where arcing or overheating may occur		P
28.1.2	Internal batteries provided as part of power packs shall be lead acid, in accordance with 28.2, or lithium-ion, in accordance with 28.3	lithium-ion battery used. Comply with 28.3	P
28.1.3	If the internal battery is removable by the user, the battery pack shall be keyed or provided with a means to prevent inadvertent reverse polarity connections when replacing the battery pack. If the battery pack is not provided with this means of prevention, then the power pack is subjected to the test in 50.10	Non-detachable battery.	N/A
28.2	Lead acid batteries	Lithium-ion battery	N/A
28.2.1	A lead acid battery shall comply with the requirements in the Standard for Standby Batteries, UL1989.		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		N/A
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 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 and CAN/CSA E62133.	Complied with UL 1642	P
28.3.2	The power pack shall provide a means of reverse polarity protection or the test of 50.3 shall be performed.	Not booster cables	N/A
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

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Clause	Requirement – Test	Result – Remark	Verdict
29	**Spacings**		P
29.1	Spacings between hazardous live parts of opposite polarity, and between hazardous live and dead metal parts shall not be less than specified in Table 29.1. If an uninsulated hazardous 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 hazardous live part, the construction shall be such that at least the minimum spacings are maintained. See 29.2.	Hazardous live-dead metal parts CL:>10mm, limit 6.4mm CR: >10mm, limit 9.5mm	P
	Exception No. 1: Spacings between traces on a printed-wiring board need not comply with Table 29.1 if the printed-wiring board complies with the Printed-Wiring Board Abnormal Test, 50.6. The requirements specified in 50.6 do not substitute for the minimum required spacings between the printed-wiring board foils and dead metal parts or the spacings between the primary and secondary board as specified in Table 29.1.		N/A
	Exception No. 2: This requirement does not apply to spacings complying with 29.5 – 29.9.		N/A
	Exception No. 3: This requirement does not apply to spacings complying with 29.10 and 29.11.		N/A
29.2	The spacing requirements in Table 29.1 do not necessarily apply to the inherent spacings of a component or assembly of a power pack. This includes switches, fuses, transformers, attachment plugs, and similar components or assemblies. Such spacings shall comply with the requirements for that component or assembly in question, where actual spacing requirements exist.		P
29.3	In a low voltage, limited energy secondary circuits, spacings of live parts in-between or live parts to grounded dead metal are not specified		N/A
29.4	Epoxy or equivalent material may be used to reduce spacings when all of the following are met:		N/A
	a) Spacings of a minimum 0.8 mm (1/32 inch) are maintained prior to application of the encapsulant;		N/A
	b) There are no significant voids in the encapsulant;		N/A
	c) The encapsulant is a minimum 0.8 mm (1/32 inch) thick;		N/A
	d) The area of reduced spacing, with the encapsulant applied, complies with the Dielectric Voltage Withstand Test, Section 48; and		N/A
	e) The encapsulant temperature during the Normal Temperature Test, Section 47, does not exceed 65°C (117°F) rise [based on an assumed operating ambient rating of 25°C (77°F)] or 90°C (194°F) limit (when tested at an ambient rating of greater than 25°C).		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Exception: When the encapsulant is suitable for use at a higher operating temperature, the temperature shall not exceed the material temperature rating.		N/A
29.5	As an alternative to the spacing requirements of Table 29.1, the spacing requirements in the Standard for Insulation Coordination Including Clearance and Creepage Distances for Electrical Equipment, UL 840, and Insulation Coordination, CAN/CSA C22.2 No. 0.2, may be used. The spacing requirements of UL 840 and CAN/CSA C22.2 No. 0.2 are not to be used for spacings to a dead metal enclosure. In determining the pollution degree and overvoltage category, the end use application is to be considered and may modify those characteristics given in 29.6 and 29.7.		N/A
29.6	Power packs are considered to be used in a pollution degree 3 environment. Hermetically sealed or encapsulated enclosures, or coated printing-wiring boards in compliance with the Printed Wiring Board Coating Performance Test of the Standard for Insulation Coordination Including Clearance and Creepage Distances for Electrical Equipment, UL 840, and Insulation Coordination, CAN/CSA C22.2 No. 0.2, are considered pollution degree 1.		N/A
29.7	It is anticipated the equipment will be rated overvoltage category II or overvoltage category I as defined in the Standard for Insulation Coordination Including Clearance and Creepage Distances for Electrical Equipment, UL 840, and Insulation Coordination, CAN/CSA C22.2 No. 0.2.	Overvoltage category II	P
29.8	In order to apply clearance B spacings, control of overvoltage shall be achieved by providing an overvoltage device or system as an integral part of the product		N/A
29.9	For the purpose of power packs covered by these requirements, all printed-wiring boards are considered to have a minimum comparative tracking index of 100 without further evaluation.		N/A
29.10	An insulating liner or barrier of material such as vulcanized fiber or thermoplastic employed in lieu of required spacings shall not be less than 0.71 mm (0.028 inch) thick and shall be so located or of such material that it is not adversely affected by arcing.		N/A
	Exception: Vulcanized fiber not less than 0.33 mm (0.013 inch) thick or mica not less than 0.165 mm (0.0065 inch) thick may be used:		N/A
	a) In conjunction with an air spacing of not less than 50 percent of the minimum through air spacing;		N/A
	b) Between a heat sink and a metal mounting surface, including the enclosure, of an isolated secondary circuit rated 50 Vrms or less.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
29.11	Insulating material having a thickness less than that specified in 29.10 may be used if, upon evaluation, it is found to comply with the requirements for the application, and has a dielectric breakdown strength of not less than 5000 volts in the thickness used for 29.10 – 2500 volts in the thickness used for the Exception to 29.10 – as determined by Tests on Insulating Materials, Section 61.		N/A
29.12	Film coated wire is regarded as an uninsulated live part when spacings are being considered		N/A
30	**Inverters**		P
30.1	Inverters provided as part of the power bank shall be shown to comply with the applicable requirements in this outline. See 30.2		P
	Exception: Inverters that comply with the Standard for Power Units Other Than Class 2, UL 1012, and Power Supplies, CAN/CSA C22.2 No. 107.1, comply without further evaluation.		P
30.2	With reference to 30.1, specific attention should be given to: a) Printed-Wiring Boards, Section 25;		P
	b) Spacings, Section 29;		P
	c) Normal Temperature Test, Section 47;		P
	d) Dielectric Voltage Withstand Test, Section 48; and		P
	e) Abnormal Operation Tests, Section 50.		P
	Other requirements shall also apply as applicable.		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, and Battery Chargers, CAN/CSA C22.2 No. 107.2.		N/A
Protection Against Injury to Persons			P
32	**General**		P
32.1	If the operation and maintenance of a power pack by the user involves a risk of injury to persons, means shall be provided to reduce the risk		P
32.2	When judging a power pack with respect to the requirement in 32.1, consideration shall be given to reasonably foreseeable misuse of the power pack		P

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Clause	Requirement – Test	Result – Remark	Verdict
32.3	Whether a guard, a release, an interlock, or the like is required, and whether such a device meets the intent of the requirement, shall be determined from an evaluation of the complete power pack, its operating characteristics, and the likelihood of a risk of injury to persons resulting from a cause other than gross negligence. The evaluation shall include consideration of the results of breakdown or malfunction of any component, but not more than one component at a time, unless one event contributes to another. If the evaluation shows that breakdown or malfunction of a particular component can result in a risk of injury to persons, that component is to be investigated for reliability.		P
33	**Back Feed Protection**		P
33.1	Power packs shall be provided with back feed protection such that no current is passed through the device from the internal battery to the power supply input connections. Constructional features shall be provided to prevent this under normal operation and single fault condition. As an alternate means of determining compliance, the measurements in the Back Feed Test, Clause 66, can be performed.		P
34	**Sharp edges**		P
34.1	An enclosure, an opening, a frame, a guard, a knob, a handle, or the like, shall not be sufficiently sharp to cause a risk of injury to persons in normal maintenance or use	Edges and corners of the enclosure are rounded.	P
35	**Strength of enclosure**		P
35.1	The enclosure shall be tested in accordance with the strength of enclosure test in Section 55		P
36	**Attachments**		N/A
36.1	The functional attachments shall be evaluated together with the power pack		N/A
37	**Stability**		P
37.1	A power pack shall be tested as described in Stability Test, Section 58. No overturn, or any risk/injury posed on persons as result of the test		P
38	**Strength of handles**		P
38.1	A handle used to support or carry a product shall be subjected to the Strength of Handles Test, Section 57.		P
39	**Surface temperatures**		P
39.1	During the Normal Temperature Test, Section 47, the temperature of a surface that may be contacted by the user shall not be more than the value specified in Table 39.1. If the test is conducted at a room temperature of other than 25°C (77°F), the results are to be corrected to that temperature.		P

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Clause	Requirement – Test	Result – Remark	Verdict
40	**Safety circuits and Control Circuits**		N/A
40.1	Circuits that are provided to limit outputs, switch outputs, control operational functions and the like, are considered safety circuits or control circuits, if their failure to provide their intended function will result in a hazardous condition or a risk of fire, shock, or injury to the user. Circuits that are classified as safety circuits or control circuits shall be evaluated to the applicable requirements in the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1 and CAN/CSA C22.2 E60730-1.		N/A
Performance			
41	**General**		P
42	**Power Input Test**		P
43	**Normal Charging Operation Test**		P
44	**Lithium Charging System Test**		P
45	**Capacitor Discharge Test**		P
46	**Leakage current Test**		P
47	**Normal Temperature Test**		P
47.1	General		P
47.2	Maximum normal load		P
47.3	Power pack ampacity temperature test		N/A
48	**Dielectric Voltage Withstand Test**		P
49	**Leakage current following humidity conditioning**		P
50	**Abnormal operation test**		P
50.1	General		P
50.2	Output short test		P
50.3	Reverse polarity of booster cables		N/A
50.4	Component faults		P
50.5	Relay and solenoid burnout		N/A
50.6	Printed wiring board abnormal test		P
50.7	Disconnected fan test		P
50.8	Blocked ventilation test		P
50.9	Overcharging test		P
50.10	Internal battery reverse polarity test		N/A
51	**Vibration test**		P
52	**Ground continuity**		P
53	**Overload tests**		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
53.1	General		N/A
53.2	Overload of switches and controls test		N/A
53.3	Overload of protection devices		N/A
53.4	Overload of interlocks		N/A
54	**Strain Relief Test**		N/A
55	**Strength of enclosure tests**		P
55.1	General		P
55.2	Impact test		P
55.3	Drop test		N/A
56	**Mold stress test**		P
57	**Strength of handles test**		N/A
58	**Stability test**		P
59	**Hydrostatic strength test**		N/A
60	**Rain test**		N/A
61	**Tests on insulation material**		P
62	**Accelerated aging of gaskets, sealing compound, and adhesive test**		N/A
63	**Metallic coating thickness test**		N/A
64	**Permanency of wrapping hang tag marking**	No such marking	N/A
65	**Power pack ampacity test**		P
66	**Back feed test**		P
67	**Cold bend test**		N/A
68	**Clamp tests**		N/A

MARKING			
69	**General**		P
69.1	A product shall be legibly and permanently marked with:		P
	a) The manufacturer's name, trade name, trademark, or other descriptive marking by which the organization responsible for the product may be identified;	See copy of marking plate.	P
	b) A distinctive model number or the equivalent;	See copy of marking plate.	P
	c) The electrical rating;	See copy of marking plate.	P
	d) The operating temperature range as specified by the manufacturer; and	See copy of marking plate.	P
	e) The date or other dating period of manufacture not exceeding any three consecutive months		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Exception: The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code: a) Does not repeat in less than 10 years; and b) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.		P
69.2	When a manufacturer produces or assembles a power pack at more than one factory, each finished power pack shall have a distinctive marking, to identify it as the product of a particular factory.	Only one factory	N/A
69.3	With reference to 69.1 and the Cautionary Markings, Section 70, the markings shall be legible and permanent. These markings shall be:		P
	a) Molded, die-stamped, paint stenciled, stamped or etched metal that is permanently secured;		N/A
	b) Pressure sensitive label complying with the applicable requirements for indoor and outdoor use labels in the Standard for Marking and Labeling Systems, UL 969, at the indicated temperature rating, up to 70°C (158°F) on the specified surface; or		P
	c) A hang tag applied to a hose or cord, provided the hang tag complies with the requirements in the Permanency of Wrapped Hang Tag Marking Test, Section 64.		N/A
69.4	Power packs intended to be used or marketed for use in repair facilities, the power pack shall be marked “suitable for use in a repair facility.”	Not for that purpose	N/A
70	**Cautionary markings**		P
70.1	A product having a hidden or unexpected risk of injury to persons shall be marked to inform the user of the risk.		P
70.2	A cautionary marking shall be permanent and legible, in accordance with 69.3, and shall be located on a permanent part of the product		P
70.3	A cautionary marking intended to instruct the operator shall be legible and visible from the position normally assumed by the operator when starting the product or from the position normally assumed or the specific operation involved. Other such markings for servicing or making settings and adjustments shall be legible and visible to the individual when such work is being done		P

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Clause	Requirement – Test	Result – Remark	Verdict
70.4	A marking intended to inform the user of a risk of injury to persons shall be prefixed by a signal word “CAUTION,” WARNING,” or “DANGER.” The marking shall be in letters not less than 3/32 inch (2.4mm) high. The signal word shall be more prominent than any other required marking on the product		P
70.5	The literature accompanying a package containing a basic product and attachments intended to be marketed as a complete unit shall indicate what attachments are intended for use with the basic product if use of such attachments may expose the user to a risk of injury		P
70.6	An attachment that is packaged and marketed separately from the basic product and recommended by the manufacturer for use on the basic product shall be marked to identify the basic product with which it is intended to be used. The identification shall appear in at least one of the following locations:	Not separately	N/A
	a) On the attachment;		N/A
	b) On the package housing the attachment;		N/A
	c) In the instruction book for the basic product; or		N/A
	d) In information furnished with the attachment.		N/A
70.7	For components or assemblies used in power packs, such as air compressors, internal batteries, and the like, specific cautionary markings may exist on the enclosure or body of these components are assemblies and which may not be visible to the user once installed in the power pack. If the risk is not removed or reduced due to the installation of this component or assembly in the power pack, then the cautionary marking appearing on the component or assembly shall be repeated on the power pack		N/A
70.8	A compartment involving a risk of electric shock and housing no user serviceable parts shall be marked where readily visible during any approach to servicing. The marking shall consist of the word “CAUTION” and the following or equivalent: “Risk Of Electric Shock, Do Not Remove Cover. No User Serviceable Parts Inside. Refer Servicing to Qualified Service Personnel.”		P
70.9	The locations and type designations of user serviceable components shall be marked on the power pack where the marking will be readily visible during servicing of the components, unless replacement of the component by a different type cannot result in a risk of fire, electric shock, or injury to persons		P

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Clause	Requirement – Test	Result – Remark	Verdict
70.10	There shall be a replacement marking adjacent to a user accessible fuse or fuseholder if the fuse is used to reduce the risk of fire or electric shock. The marking shall be located where it will be readily visible during replacement of the fuse, and shall consist of the word “CAUTION” and the following or equivalent: “For Continued Protection Against Risk Of Fire, Replace Only With Same and rating of fuse.” If the fuse is soldered in place and is perceptible during user servicing, the marking shall, in addition to the above, include the following wording or the equivalent: “Refer Replacement To Qualified Service Personnel”.		N/A
70.11	A power pack that contains an internal battery that is to be charged shall be marked with the word “WARNING” and the following or equivalent:	See marking label.	P
	a) Do not overcharge the internal battery – See Instruction Manual.		P
	b) Do not smoke, strike a match, or cause a spark in the vicinity of the power pack.		P
	c) Only charge the internal battery in a well ventilated area.		P
70.12	A power pack shall be plainly marked with the word “CAUTION” and the following or the equivalent: “Risk of Electric Shock. Connect only to properly grounded outlets.”		N/A
70.13	A power pack shall be plainly marked with the word “CAUTION” and the following or the equivalent: “Risk of Injury To Persons. Do not use this product if the power cord or the battery cables are damaged in any way.		P
70.14	For polarity identification, one clamp shall be black and the other clamp shall be a contrasting color, other than white at each end of the battery booster cable set. In addition, the contrasting color clamps shall be marked “+” and “POS” or “POSITIVE”, the black clamps shall be marked “–” and “NEG” or “NEGATIVE.”		N/A
70.15	Instructions pertaining to the proper use and connection of the battery cables shall appear on the power pack and as written instructions in the Operating Instructions provided with the product		P
70.16	Power packs which incorporate an interlock device complying with Section 26, Interlocks, shall be marked where readily visible by any personnel attempting to defeat the interlock. The marking shall include the word “WARNING” and the following or the equivalent: “Risk of Electric Shock. This cover is provided with an interlock. Do not defeat its purpose or attempt to service without removing cover completely.” The general location of the interlock shall also be indicated.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
70.17	With reference to 6.2, the power pack shall be marked with the word “WARNING” and the following or the equivalent: “Risk of Explosion. This equipment has arcing or sparking parts which should not be exposed to flammable vapors. This equipment should be located at least 457 mm (18 inches) above the floor when used in a repair facility.”	Not intended for use within a repair facility	N/A
70.18	With reference to 6.2, a power pack that is not intended to be used in a repair facility shall be marked with the word “CAUTION” and the following or the equivalent: “This device is not intended for use in a commercial repair facility.”		N/A
70.19	With reference to 6.3, temporary outdoor use power packs shall be marked with the word “CAUTION” and the following or the equivalent: “This device is intended to be stored indoors when not in use. This device shall not be stored or left outdoors when not in use.”	See marking label.	P
70.20	With reference to 6.3, temporary outdoor use power packs shall be marked with the word “CAUTION” and the following or the equivalent: “This device is intended for temporary use outdoors and reasonable care should be exercised when using this device in wet conditions.”	This device is intended to be used indoors only.	N/A
70.21	With reference to 6.3, indoor use only devices shall be marked “DANGER” and the following or the equivalent: “This device is intended to be used indoors only. Do not use outdoors.”		N/A
70.22	With reference to 6.4 and 7.3.3, products with an enclosure RTI rating less than 80°C shall be marked with the word “WARNING” and the following or the equivalent: “Risk of Electric Shock and Risk of Fire. This device is not to be stored in a vehicle.	RTI: 80°C	P

INSTRUCTIONS			
71	**General**		P
71.1	A product shall be provided with legible installation instructions, operation instructions, and instructions pertaining to a risk of fire, electric shock, or injury to persons associated with the use of the product. Also, user maintenance instructions and moving and storage instructions associated with the use of the product by the end user shall be included		P
71.2	The instructions mentioned in 71.1 shall be:		P
	a) In separate manuals, or		P
	b) Combined in one or more manuals when the instructions pertaining to a risk of fire, electrical shock, or injury to persons are separated in format and emphasized to distinguish them from the rest of the text.		P

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Clause	Requirement – Test	Result – Remark	Verdict
71.3	An illustration is allowed with a required instruction to clarify the intent but shall not replace the written instruction.		P
71.4	The following items shall be entirely in upper case letters or shall be emphasized to distinguish them from the rest of the text:		P
	a) The headings for the installation, operation, user maintenance, and moving and storage instructions;		P
	b) The heading for the instructions pertaining to a risk of fire, electric shock, or injury to persons; and		P
	c) The opening and closing statements of the instructions specified in 72.3 – “IMPORTANT SAFETY INSTRUCTIONS” and “SAVE THESE INSTRUCTIONS,” or the equivalent.		P
71.5	Unless otherwise indicated, the text of the instructions in 72.3 and 72.4 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.		P
72	**Instructions Pertaining to Risk of Fire, Electric Shock, or Injury to Persons**		P
72.1	Instructions pertaining to a risk of fire, electric shock, 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, ELECTRIC SHOCK, OR INJURY TO PERSONS” or the equivalent		P
72.2	Numbering of the items in the list in 72.3 and including other instructions pertaining to a risk of fire, electric shock, or injury to persons that the manufacturer determines to be necessary and that do not conflict with the intent of the instructions are acceptable		P
72.3	The instructions pertaining to a risk of fire, electric shock, 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		P
	IMPORTANT SAFETY INSTRUCTIONS		P
	WARNING – When using this product, basic precautions should always be followed, including the following:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	a) Read all the instructions before using the product.		P
	b) To reduce the risk of injury, close supervision is necessary when the product is used near children.		P
	c) Do not put fingers or hands into the product.		P
	d) Use of an attachment not recommended or sold by power pack manufacturer may result in a risk of fire, electric shock, or injury to persons.		P
	e) To reduce risk of damage to the electric plug and cord, pull the plug rather than the cord when disconnecting the power pack.		N/A
	f) Do not use a battery pack or appliance that is damaged or modified. Damaged or modified batteries may exhibit unpredictable behavior resulting in fire, explosion or risk of injury.		P
	g) Do not operate the power pack with a damaged cord or plug, or a damaged output cable.		N/A
	h) Do not disassemble the power pack, take it to a qualified service person when service or repair is required. Incorrect reassembly may result in a risk of fire or electric shock.		P
	i) To reduce the risk of electric shock, unplug the power pack form the outlet before attempting any instructed servicing.		P
	j) WARNING – RISK OF EXPLOSIVE GASES.		N/A
	1) WORKING IN VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. FOR THIS REASON, IT IS OF THE UTMOST IMPORTANCE THAT YOU FOLLOW THE INSTRUCTIONS EACH TIME YOU USE THE POWER PACK.		N/A
	2) To reduce risk of battery explosion, follow these instructions and those published by battery manufacturer and manufacturer of any equipment you intend to use in vicinity of the battery. Review cautionary marking on these products and on engine.		P
	k) PERSONAL PRECAUTIONS		N/A
	1) Consider having someone close enough by to come to your aid when you work near a lead-acid battery.	Lithium battery	N/A
	2) Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.		N/A
	3) Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	4) If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 10 minutes and get medical attention immediately.		N/A
	5) NEVER smoke or allow a spark or flame in vicinity of battery or engine.		N/A
	6) Be extra cautious to reduce risk of dropping a metal tool onto battery. It might spark or short-circuit battery or other electrical part that may cause explosion.		N/A
	7) Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery can produce a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.	Lithium battery	N/A
	l) When charging the internal battery, work in a well ventilated area and do not restrict ventilation in any way.		N/A
	m) Under abusive conditions, liquid may be ejected from the battery; avoid contact. If contact accidentally occurs, flush with water. If liquid contacts eyes, additionally seek medical help. Liquid ejected from the battery may cause irritation or burns.		N/A
	n) Do not expose a power pack to fire or excessive temperature. Exposure to fire or temperature above 130°C may cause explosion. The temperature of 130°C can be replaced by the temperature of 265°F.		N/A
	o) Have servicing performed by a qualified repair person using only identical replacement parts. This will ensure that the safety of the product is maintained.		N/A
	p) Attach output cables to a battery and chassis as indicated below. Never allow the output clamps to touch one another.		N/A
	1) Instructions shall include step by step directions for the proper use of the booster function detailing the correct steps to connect and disconnect the booster cables to the battery.		N/A
	2) Each step shall be a different numbered item.		N/A
	SAVE THESE INSTRUCTIONS		P
72.4	The instructions pertaining to a risk of fire, electric shock, or injury to persons, or the installation instructions shall include the following items if applicable. If the following instructions are included in the installation instructions, a reference to these instructions shall be included in the list mentioned in 72.3 as a separate item. The headings and the word “WARNING” shall be entirely in upper case letters or shall be emphasized to distinguish it from the rest of the text.		P
	GROUNDING INSTRUCTIONS		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	This product must be grounded. If it should malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This product is equipped with a cord having an equipment grounding conductor and a grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codesordinances.		N/A
	WARNING – Improper connection of the equipment grounding conductor is able to result in a risk of electric shock. Check with a qualified electrician if you are in doubt as to whether the product is properly grounded. Do not modify the plug provided with the product – if it will not fit the outlet, have a proper outlet installed by a qualified electrician.		N/A
73	**Installation instructions**		P
74	**Operating Instructions**		P
75	**User Maintenance Instructions**		P
76	**Moving and Storage Instructions**		P

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Clause	Requirement – Test	Result – Remark	Verdict

12.4	DC output connectors and USB connectors	P

Both under normal operating conditions and after any single fault in the regulating network (open-circuit or short-circuit)

under normal load condition

USB-A QC3.0 output load 5V 3A, 9V 2A, 12V 1.5A,

Output Voltage (Voc)			Output Current (Isc)		VA	
V ac	V dc	Measured	Max Allowed	Measured	Max Allowed	Measured
<30	<30	5.12	<8A	3.66	<240	18.30
<30	<30	9.02	<8A	3.65	<240	23.83
<30	<30	12.04	<8A	3.61	<240	22.90

(fault condition with C4 Short-circuit)

Output Voltage (Voc)			Output Current (Isc)		VA	
V ac	V dc	Measured	Max Allowed	Measured	Max Allowed	Measured
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0

USB-C PD20W Output load 5V 3A, 9V 2.22A, 12V 1.67A

Output Voltage (Voc)			Output Current (Isc)		VA	
V ac	V dc	Measured	Max Allowed	Measured	Max Allowed	Measured
<30	<30	5.12	<8A	3.73	<240	17.66
<30	<30	9.02	<8A	2.81	<240	23.96
<30	<30	12.11	<8A	2.15	<240	23.84

(fault condition with C4 Short-circuit)

Output Voltage (Voc)			Output Current (Isc)		VA	
V ac	V dc	Measured	Max Allowed	Measured	Max Allowed	Measured
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0

USB-C PD100W Output load 5V3A, 9V3A,12V3A,15V3A,20V5A

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

Output Voltage (Voc)			Output Current (Isc)		VA	
V ac	V dc	Measured	Max Allowed	Measured	Max Allowed	Measured
<30	<30	5.02	<8A	3.78	<240	17.70
<30	<30	9.09	<8A	3.76	<240	31.15
<30	<30	12.03	<8A	3.51	<240	49.62
<30	<30	15.11	<8A	3.80	<240	54.73
<30	<30	20.02	<8A	5.45	<240	106.0
(fault condition with C4 Short-circuit)						
Output Voltage (Voc)			Output Current (Isc)		VA	
V ac	V dc	Measured	Max Allowed	Measured	Max Allowed	Measured
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0
<30	<30	0	<8A	0	<240	0

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Clause	Requirement – Test	Result – Remark	Verdict

42	TABLE: Power Input Test					P
Hz	Irated (W)	U (V)	P (W)	I (A)	Ifuse (A)	condition/status
50	--	90VAC	1140	5.88	5.88	Empty Battery charging only, Battery charging current: 17.77A
60	---	90VAC	1146	5.42	5.42	Empty Battery charging only, Battery charging current: 17.89A
50	1100	100VAC	1149	5.39	5.39	Empty Battery charging only, Battery charging current: 17.79A
60	1100	100VAC	1152	5.42	5.42	Empty Battery charging only, Battery charging current: 17.89A
50	1100	120VAC	1132	5.33	5.33	Empty Battery charging only, Battery charging current: 17.79A
60	1100	120VAC	1132	5.28	5.28	Empty Battery charging only, Battery charging current: 17.68A
50	--	132VAC	1129	4.89	4.89	Empty Battery charging only, Battery charging current: 17.81A
60	--	132VAC	1129	4.77	4.77	Empty Battery charging only, Battery charging current: 17.83A
--	--	51.2VDC	2400	48.5	--	Only discharging mode:AC Output: 2400W
Note: <=10% of Rated current under the conditions of max. normal load (max. current draw while the device is operating in all possible modes at the same time)						

43	TABLE: Normal Charge Operation Test	P
Battery charging test		
Charge battery (at ambient temperature) 24.8°C(90VAC input)		

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Clause	Requirement – Test	Result – Remark	Verdict

Charging voltage (V) max	Charging Current (A) max	Battery temperature °C max	Remark
4.25	1.68	34.6	Group 1
4.25	1.68	34.2	Group 2
4.25	1.68	34.4	Group 3

Charge battery (at rated minimum temperature – 5°C if the minimum temperature lower than 4°C) Stop charge(90VAC input)

Voltage (V)	Current (A)	Battery temperature	Remark
4.25	0.27	-5.0	Group 1
4.25	0.27	-5.0	Group 2
4.25	0.27	-5.0	Group 3

Charge battery (at rated maximum temperature) (90VAC input)

Charging voltage (V)	Charging Current (A)	Battery temperature	Remark
4.25	0.01	56.8	Group 1
4.25	0.01	56.8	Group 2
4.25	0.01	56.9	Group 3

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

Battery imbalance test (if series configuration)

Voltage (V)	Current (A)	Battery temperature	Remark
3.65	1.03	25.9	Group 1
3.65	1.03	25.9	Group 2
3.65	1.03	25.8	Group 3

Note: at first fully discharge the battery, and subsequently charged one of the cells to 50% SOC

44	TABLE: Lithium Charging System Test	**P**

Battery charging test at abnormal conditions

Test a), b)

Battery with cells in series configuration

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Clause	Requirement – Test	Result – Remark	Verdict

Test configuration:

Fully discharge the battery, afterwards charge one of the cells up to 50% SOC, fault a component on the charger circuit, then charge the battery

Charge termination:

Charge until exploding, catching fire, battery temperature returned to room temperature, 7 hours or twice of the normal charging period (fully) which one is longer (the cells' voltage shall be always monitored during the test)

Goup 1 voltage (V)	Group 2 voltage(V)	Group 3 voltage (V)	Remark
3.65	3.60	3.61	1group Fault condition: Q1 2-3SC

Test c)

Battery with cells in series configuration

Test configuration:

Fully discharge the battery, afterwards charge all cells up to 50% SOC except one of the cells is short-circuit, then charge the battery

Charge termination:

Charge until exploding, catching fire, battery temperature returned to room temperature, 7 hours or twice of the normal charging period (fully) which one is longer (the cells' voltage shall be always monitored during the test)

Goup 1 voltage (V)	Group 2 voltage(V)	Group 3 voltage (V)	Remark
3.65	3.65	3.65	1group Fault condition: Q1 2-3SC
3.65	3.65	3.65	11group Fault condition: Q1 2-3SC

Test d)

Battery regardless of its configuration. Evaluate the effect of back-feed by the battery

Test configuration:

Fully charged battery. Short-circuit of a component in the charging system expected to produce the most unfavorable results.

Charge termination:

Charge until exploding, catching fire, battery temperature returned to room temperature, 7 hours or twice of the normal charging period (fully) which one is longer (the cells' voltage shall be always monitored during the test)

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Clause	Requirement – Test	Result – Remark	Verdict

Location	V measured	mA measured	Remark
Input connection 90VAC	Group 1=4.25 Group 2=4.25 Group 3=4.25	Group 1=0.1 Group 2=0.1 Group 3=0.1	Fault condition: Q1 D-S Stop charge
Note:			

45	TABLE: Capacity Discharge Test			P
Condition	τ calculated (s)	τ measured (s)	t u→ 0V (s)	Comments
Input socket	--	--	--	Plug pin measured: ___508_Vpeak, 37%Vpeak= __187.96V Within 1s: 98V
Overall capacity: Discharge resistor: Note: **Pass: time constant <1s, if C<=0.1μ no test required.**				

46	TABLE: Leakage Current Test								**P**
		Measured Leakage Current, mA							
		Switch 2 Position 1				Switch 2 Position 2			
Condition	Switch S1	(a)	(b)	(c)	d)	(a)	(b)	(c)	d)
USB-C PD100W Output to earth	Open	0.487 mA	0.487 mA	0.487 mA	0.487 mA	-	-	-	-
	Closed	0	0	0	0				
	0-5 s	0.487 mA	0.487 mA	0.487 mA	0.487 mA	-	-	-	-
	Thermal stability established	-	-	-	-	-	-	-	-
	Cooling condition	-	-	-	-	-	-	-	-
Note:									

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Clause	Requirement – Test	Result – Remark	Verdict

47.1	TABLE: maximum temperatures		**P**
	test voltage (V)	90Vac Only charging / 51.2Vdc Discharging, Max. load	—
	t_{amb1} (°C)		—
	t_{amb2} (°C)		—

maximum temperature T of part/at::	T (K)		Limit(K)
	90Vac Only charging	51.2Vdc Discharging, Max. load	
AC inlet	20.9	42.5	65
Internal input wire	13.7	43.9	90
CX5 body	31.9	45.2	40
CX4 body	38.8	48.3	40
LF3 winding	33.7	44.9	80
LF2 winding	33.7	44.9	80
L3 winding	37.6	44.9	80
L1 winding	34.9	46.2	80
C50 body	35.2	45.2	40
C56 body	37.2	48.3	40
C99 body	39.7	49.3	40
L2 winding	41.5	50.5	80
T5 winding	14.9	31.7	80
T5 core	11.7	28.1	80
TX3 winding	23.5	31.5	80
TX3 core	21.7	27.2	80
T4 winding	33.3	53.5	80
T4 core	29.9	47.7	80
T2 winding	23.9	37.2	80
T2 core	21.7	33.7	80

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Clause	Requirement – Test	Result – Remark	Verdict

T3 winding	17.2	35.1	80
T3 core	13.9	32.2	80
T1 winding	16.5	35.1	80
T1 core	12.8	27.2	80
C49 body	21.6	44.9	40
C54 body	26.2	46.2	40
C13 body	13.7	41.9	40
C3 body	11.6	40.7	40
CY2 body	20.6	52.3	80
Battery wire	12.4	17.6	90
Battery body	13.8	20.5	Ref
DC fan	4.6	14.9	Ref
Plastic enclosure inside near bottom battery	7.8	16.8	105
Plastic enclosure outside near bottom battery	2.9	13.9	35
Ambient	25.0	25.0	Ref

Note:

temperature T of winding:	R_1 (Ω)	R_2 (Ω)	T (°C)	allowed T_{max} (°C)	insulation class
--	--	--	--	--	--

Note:

47.3	TABLE: Power Pack Ampacity Temperature Test	**N/A**

Location	Measured (°C)	Limit (°C)
--	--	--

Note: the output voltage loaded to the lowest constant output voltage (for example 10V) through an electronic load for 25 seconds or a duration inherently allowed by the battery pack, measure the temperature of above parts during the test.

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

48	Table: Dielectric Voltage Withstand Test	P

test voltage applied between:	test voltage (V)	breakdown Yes / No
SELV ports- AC socket	1000+2 x Ur	No
Accessible parts- AC socket	1000+2 x Ur	No
supplementary information		
Note: Test voltage a.c., 60Hz, 1minute. Ur is the highest rated voltage		

49	TABLE: Leakage Current Test Following Humidity Conditioning	P

		Measured Leakage Current, mA							
Condition	Switch S1	Switch 2 Position 1				Switch 2 Position 2			
		(a)	(b)	(c)	d)	(a)	(b)	(c)	d)
USB-C PD100W Output to earth	Open	0.487 mA	0.487 mA	0.487 mA	0.487 mA	--	-	-	-
	Closed	0	0	0	0				
	0-5 s	0.487 mA	0.487 mA	0.487 mA	0.487 mA	--	--	--	--
	Thermal stability established	--	--	--	--	--	--	--	--
	Cooling condition	--	--	--	--	--	--	--	--
Note: the leakage current test is perform immediately after the treatment 48 hours, 32°C, 90% R.H									

50	TABLE: Abnormal Operation Tests		P
	ambient temperature (°C) ..... :	1) t1: __24.8°C ___; t2: __25.0°C ____	—
	model/type of power supply ..... :	-	—
	manufacturer of power supply ..... :	-	—
	rated markings of power supply ..... :	-	—

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
Charging condition: 90VAC input						
C49	S-C	90VAC	10mins	--	--	Input current: 5.42A→0.02A Battery current: 17.89A→0.01A EUT shutdown, Unrecoverable, no hazard no damage.
C43	S-C	90VAC	10mins	--	--	Input current: 5.42A→0.02A Battery current: 17.89A→0.01A EUT normal operation, no hazard no damage.
U1 pin 6-9	S-C	90VAC	10mins	--	--	Input current: 5.42A→0.02A Battery current: 17.89A→0.01A EUT normal operation, no hazard no damage.
Battery pack	Overcharging test*	90VAC	10mins	--	--	Input current: 5.42A→5.42A Battery current: 17.89A→17.89A EUT normal operation, no hazard no damage.

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

Discharging(Battery is full)condition:						
USB-A QC3.0	O-L	12VDC	3h45min	--	--	Battery discharging current: 48.50A to 48.62A USB-A QC3.0 output overload to 5.22 A get max. temperature, then USB-A QC3.0 output shutdown at 3.30A, other output port work normally, no hazardous,. T1 winding: 65.6°C, T2 winding: 64.7°C, T3 winding: 62.2°C T4 winding: 81.3°C T5 winding: 58.6°C Battery body: 46.7°C, Plastic enclosure outside near bottom battery: 40.1°C, Ambient: 25.0°C.

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

USB-C PD20W	O-L	12VDC	4h21min	--	--	Battery discharging current: 48.50A to 48.66A USB-C PD20W output overload to 3.55 A get max. temperature, then USB-C PD20W output shutdown at 2.90A, other output port work normally, no hazardous. T1 winding: 66.6°C, T2 winding: 65.2°C, T3 winding: 63.3°C T4 winding: 83.4°C T5 winding: 58.7°C Battery body: 47.5°C, Plastic enclosure outside near bottom battery: 40.8°C, Ambient: 25.0°C.

CAN/UL 2743: 2020						
Clause	Requirement – Test				Result – Remark	Verdict
USB-C PD100W	O-L	20VDC	4h02min	--	--	Battery discharging current: 48.50A to 49.22A USB-C PD100W output overload to 3.55 A get max. temperature, then USB-C PD100W output shutdown at 2.90A, other output port work normally, no hazardous. T1 winding: 68.8°C, T2 winding: 67.6°C, T3 winding: 58.6°C T4 winding: 88.9°C T5 winding: 61.2°C Battery body: 48.2°C, Plastic enclosure outside near bottom battery: 41.1°C, Ambient: 25.0°C.
AC Output	O-L	51.2VDC	10mins	--	--	Battery discharging current: 48.50A to 51.23A AC Output output overload to 3.55 A get max. temperature, then AC Output output shutdown at 2.90A, other output port work normally, no hazardous. T1 winding: 71.2°C, T2 winding: 70.6°C, T3 winding: 62.2°C T4 winding: 93.6°C T5 winding: 65.5°C Battery body: 48.8°C, Plastic enclosure outside near bottom battery: 42.3°C, Ambient: 25.0°C.

CAN/UL 2743: 2020						
Clause	Requirement – Test				Result – Remark	Verdict
C49	S-C	3h10min	10mins	--	--	Battery discharging current: 48.50A to 0.02A EUT shutdown, Unrecoverable, no hazard no damage.
U1 pin 2-6	S-C	51.2VDC	10mins	--	--	Battery discharging current: 48.50A to 0.02A EUT shutdown, Unrecoverable, no hazard no damage.
Q1 Pin 2-6	S-C	51.2VDC	10mins	--	--	Battery discharging current: 48.50A to 0.02A EUT normal operation, no hazard no damage.
Fan	Break off	51.2VDC	7h	--	--	Battery discharging current: 48.50A to 48.50A EUT normal operation, no hazard no damage. T1 winding: 60.2°C, T2 winding: 62.7°C, T3 winding: 66.4°C T4 winding: 99.8°C T5 winding: 65.2°C Battery body: 45.5°C, Plastic enclosure outside near bottom battery: 41.8°C, Ambient: 25.0°C.

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

Opening	Break off	51.2VDC	3h28min	--	--	Battery discharging current: 48.50A to 48.50A EUT normal operation, no hazard no damage. T1 winding: 70.2°C, T2 winding: 68.8°C, T3 winding: 67.3°C T4 winding: 86.9°C T5 winding: 67.8°C Battery body: 45.9°C, Plastic enclosure outside near bottom battery: 43.3°C, Ambient: 25.0°C.
S-C=Short-Circuit,O-L: over load						

51	Vibration Test		**P**
Test: 4 hours, 22 cycles / per second, displacement of 6.4mm in vertical.			
Criteria: the cell shall not catch fire or explode			

52	TABLE: Grounding Continuity Test		**P**
Location		Resistant measured (Ω)	Comments
Plastic enclosure–earth		0.042	<0.1Ω
Note: pass: < =0.1 Ohm			

53	TABLE: Overload Tests						**N/A**
	ambient temperature (°C) ..... :			1) t1: _ 24.8°C ___; t2: ___25°C ___			—
	model/type of power supply ..... :			-			—
	manufacturer of power supply ..... :			-			—
	rated markings of power supply ..... :			-			—
component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result	
--	--	--	--	--	--	--	

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

--	--	--	--	--	--	--
Note: O-L=Overload						

54.1	TABLE: Strain Relief Test	**N/A**
Test: 35 pounds (156N/15.9kg) is applied any angle to the flexible cord for 1 minute (with the connections within the power pack disconnected).		
Criteria:		

54.2	TABLE: Push-Back Relief Test	**N/A**
Test: The cord is pushed back into the product in 25.4mm increment until the force exceeds 26.7N.		
Criteria:		

55.2	TABLE: Impact Test	**P**
Test: Two samples shall be tested, one is the sample as received, the other sample is that conditioned at 0°C for 4 hours. The enclosure, guard or cover shall be subject to an impact test of 6.78N-m which is produced by a steel sphere with diameter of 50.8mm and weight of 0,535kg drop from a height 1.30m. For surface other than the top, the test is conducted by a suspended steel sphere		
Criteria: After the test the following situations does not happen, a) Uninsulated live part may involve risks of electric shock b) Fail at high-pot test; or c) The spacings are less than needed		

55.3	TABLE: Drop Test	**N/A**
Test: Two samples shall be tested, one is the sample as received, the other sample is that conditioned at 0°C for 4 hours. The sample drop three times from a height of 3 feet (0.9m) to a concrete surface.		
Criteria: After the test the following situations does not happen, a) Uninsulated live part may involve risks of electric shock b) Fail at high-pot test; or c) The spacings are less than needed		

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

56	TABLE: Mold Stress Test	**P**
Test: The sample is placed into an oven at a temperature 70°C or 10 Deg C higher than the max. temperature measured in Section 47, whichever is higher. The samples is conditioned for 7 hours.		
Criteria: After the test the sample shall not show any distortion, deterioration, shrinkage, warping or softening that would allow access to live parts.		

57	TABLE: Strength of Handles Test	**P**
Test: 4 times of the battery pack weight is applied on the handle (for lift or carry), the weight is gradually increased from 0 to that weight during 5 to 10 seconds, and maintain for 1 minute.		
Criteria: After the test there shall be no breakage or crack of the handle		

58	TABLE: Stability / 10° Angle Test	**P**
Test: Place the sample on an inclined plane inclined at angle of 10 degree from the horizontal.		
Criteria: During the test the sample does not tip over.		

59	TABLE: Hydrostatic Test	**N/A**
Test: 5 times the max. pressure of the hydrostatic (the pressure shall be gradually increased) shall be applied for 1 minute on the hydrostatic pipe (pressure confining portion). Prior to the test the product shall have experienced mold stress test as specified in Section 56.		
Criteria: .		

60	TABLE: Rain Test	**N/A**
Test: The water pressure for all tests is to be maintained at 5 psig (34.5 Pa) at each of the spray heads. The distance between the center nozzle and the product is to be 5 feet (1.5 m). The spray is to be directed at a 45 degree angle from the vertical toward the product. The total exposure is to be for 1 hour. After the exposure, the outside of the enclosure is to be dried with a towel and the enclosure is Opened for inspection.		
Criteria:		

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

61	TABLE: Insulating Material Test			**P**
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
1 layer insulating tape		AC	1000 + 2Ur	No
2 layers insulating tape		AC	1000 + 2Ur	No
Note:				

62	TABLE: Accelerated Aging of Gasket, Sealing Compounds and Adhesive Test	**N/A**
Test: Test according to the testing requirement in Table 62.2.		
Criteria:		

63	TABLE: Metallic Coating Thickness Test	**N/A**
Test: Prepare the sample and test solution, and test as specified in Section 63.2-63.9		
Determine the thick:		

64	TABLE: Permanency of Wrapped Hang Tag Test	**N/A**
Test: 9 samples shall be tested. Meanwhile 3 samples to be tested as received, the 6 other samples shall be tested after pre-condition treatment. 3 as received samples: Each sample cable with attached hand tag tightly suspended and clamped at each end in a vertical plane (with the attachment plug or the fitting point upward). A 22.2N force is applied for 1 minute vertically downward in parallel with the direction of the cable, at the uppermost corner but within 6.4mm of the hand tag. The first 3 of 6 samples: Maintain temperature 87°C at an oven for 240 hours. After remove from the oven, the samples remain 23°C, 50% R.H, for 30 minutes. The second 3 of 6 samples: Conditioned for 72 hours at a temperature 32°C, 85% R.H.		
Criteria: --		

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

65	TABLE: Power Pack Ampacity Test		**P**
Constant output voltage (V)	Test duration (s)	Ampacity measured (A)	Remark
51.2VDC	5	48.5	--

66	TABLE: Back Feed Test		**P**
Location	V measured	mA measured	Comments
90VAC input	0.10V	0.021	Normal
90VAC input	0.17V	0.030	Q1 pin2-86SC
Note: above measurement shall be taken immediately after the power source disconnected from the input connection point. The internal battery shall be fully charged. Limit: 60Vdc., 3.5mA.			

67	TABLE: Cold Bend Test (Booster Cable)	**N/A**
Test: The sample and the appropriate mandrel are cooled for 4 hours at minus 40°C. After the cooling period, the sample wound onto the mandrel for 6 complete turns, the test is performed in cold chamber.		
Criteria:--		

68.2	TABLE: Cold Drop Test (Clamp)	**N/A**
Test: Three samples of the insulated clamp exposed to a low temperature -40°C for 1 hour. Afterwards, the samples drop from a height of 1.5m on a concrete surface. Following the exposure, the samples subject to the Dielectric Voltage-Withstand Test in Section 68.3.		
Criteria: --.		

68.3	TABLE: Dielectric Voltage-Withstand Test (Clamp)			**N/A**
Test voltage applied between:	Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No	
--	--	--	--	

68.4	TABLE: Secureness Test (Clamp)	**N/A**

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Clause	Requirement – Test	Result – Remark	Verdict

Test: A weight of 2 times the weight of the power pack is applied to the cable and supported by the cable for 10 minutes.
Criteria: --

4.1.2	TABLE: Critical components information				P
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity[1]
Plastic enclosure	Formosa Chemicals & Fibre Copr Plastics Div	AC310(+)	PC/ABS, min. 1.5 mm thick, rated V-0, 90°C (RTI)	UL94 UL746C	UL E162823
DC fan (four provided for external air flow)	Shenzhen Fuxi Deshuo Electronics Co. LTD	FDF7015M12	12V, 0.26A, 20.5CFM	UL 507 CSA-C22.2 No. 113	UL E518266
(Alternative)	SHENZHEN HAOZHI TECHNOLOGY CO..LTD	FD6020(X)L-(A)	12V, 0.26A, 20.5CFM	UL 507 CSA-C22.2 No. 113	UL E495404
(Alternative)	Guangzhou Sanfengda Electronic Technology Co. , Ltd.	GPWV2	12V, 0.26A, 20.5CFM	UL 507 CSA-C22.2 No. 113	UL E520492
DC fan (two provided for external air flow)	Shenzhen Fuxi Deshuo Electronics Co. LTD	FDF7015L12	12V, 0.11A, 5.8CFM	UL 507 CSA-C22.2 No. 113	UL E518266

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	SHENZHEN HAOZHI TECHNOLOGY CO..LTD	FD3010(X)L-(A)	12V, 0.11A, 5.8CFM	UL 507 CSA-C22.2 No. 113	UL E495404
(Alternative)	Guangzhou Sanfengda Electronic Technology Co. , Ltd.	GPWV8	12V, 0.11A, 5.8CFM	UL 507 CSA-C22.2 No. 113	UL E520492
Display panel	Shenzhen Yearn Electronic Technology Co.,Ltd	FOGB423918B	TFT	--	--
(Alternative)	SHENZHEN CHUANGXIANDA Electronic Technology Co.,Ltd 司	CXD12832LCD	TFT	--	--
PCB	HUIZHOU GOSPEED TECHNOLOGIES CO LTD	JF-M	V-0, 130°C	UL 94 UL 796	UL E309386
(Alternative)	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL 796	UL
AC outlet	Shenzhen B-Star Technology Co Ltd	BS-U20	125Vac, 20A	UL498 UL60320-1	UL E476907
Internal wire connecting AC outlet	DONGGUAN YIAO ELECTRONICS CO LTD	1015	Min. 14AWG, 600V, VW-1, 105°C	UL 758 CSA-C22.2 No. 127	UL E348933
Internal wire connecting AC outlet - Alternate	Interchangeable	Interchangeable	Min. 14AWG, ,min. 300V, VW-1, 105°C	UL 758 CSA-C22.2 No. 127	UL
Earthing wire	DONGGUAN YIAO ELECTRONICS CO LTD	1015	VW-1, min. 105°C, min. 18 AWG, green/yellow	UL 758 CSA-C22.2 No. 127	UL E348933

CAN/UL 2743: 2020			
Clause	Requirement – Test	Result – Remark	Verdict

(Alternate)	Interchangeable	Interchangeable	VW-1, min. 105°C, min. 18 AWG, green/yellow	UL 758 CSA-C22.2 No. 127	UL
Main board (SYD-N029-AC-PCB)					
Relay (JK1, JK2, JK3)	XIAMEN HONGFA ELECTROACOUSTIC CO LTD	HF161F-W	26A, 277VAC, T85	UL 508 CSA-C22.2 No. 14	VDE 40031410
NTC (NTC2, NTC3, NTC4)	Huizhou Lianshuo Electronics Technology Co Ltd	XGPU8	10k 1%	UL 1434 UL 60730-1	UL E502869
-Insulation tape used under NTC	SHENZHEN UNION TENDE TECHNOLOGY CO LTD	0.23mm color;GY.PK	150°C	UL 510	UL E494686
-Insulation tape used under NTC (Alternative)	SUZHOU MATLADUONA ELECTRIC MATERIAL CO.,LTD	JY313	130°C	UL 510	UL E188295
NTC (NTC2, NTC3, NTC4) (Alternative)	GUANGZHOU NEWLIFE MAGNE ELECTRICITY CO.,LTD	NL103F3435	10k 1%	UL 1434 UL 60730-1	UL E505719
-Insulation tape used under NTC (Alternative)	WU XI HUA RUN SPECIAL CO LTD	HR-310Y	130°C	UL 510	UL E214552
E-cap (C50)	Interchangeable	Interchangeable	330uF, 400Vdc, 105°C	--	--
E-cap (C56, C99)	Interchangeable	Interchangeable	680uF, 400Vdc, 105°C	--	--
Line choke (L1, L3)	Interchangeable	Interchangeable	180°C	--	--
-winding	TAI-I ELECTRIC WIRE & CABLE CO LTD	EIW, SMEIW	180°C	UL 1446	UL E85640

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Clause	Requirement – Test	Result – Remark	Verdict

Line choke (LF2, LF3)	Interchangeable	Interchangeable	155°C	--	--
-winding	Dong Guan Yida industrial Co., Ltd	xUEW/155, QA-x/155	155°C	UL 1446	UL E344055
(Alternative)	GuangDong jinyan Electrotechnics Joint stock Co.,Ltd	xUEW, QA-x/155	155°C	UL 1446	UL E238500
Fuse (F3)	ZHONG SHAN LANBAO ELECTRICAL APPLIANCES CO LTD	LB630P-30A	30A, 250V	UL 248-1 UL 248-14 CSA-C22.2 No. 248-1-00	UL E213695
Fuse (F1, F2)	Littelfuse	287040.PXCN	40A 32V	UL 248-1 UL 248-14 CSA-C22.2 No. 248-1-00	UL AU1410
(Alternative)	DONGGUAN TLC ELECTRONIC TECHNOLOGY	AB19U040	40A 32V	UL 248-1 UL 248-14 CSA-C22.2 No. 248-1-00	UL E360382
X-cap (CX5, CX4)	DONG GUAN AJC INDUSTRIAL CO LTD	MPX, MKP	X2, min. 275Vac, 110°C, 1uF	IUL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40045532
(Alternative)	CHIEFCON ELECTRONICS CO LTD	MKP	X2, min. 275Vac, 110°C, 1uF	UL 60384-14 CAN/CSA-E60384-1 (2003)	CB or other EU cert.
(Alternative)	Macrofar Electronics Technology (HK) Limited	MPX	X2, min. 275Vac, 110°C, 1uF	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40050286
(Alternative)	DONGGUAN QINHONG(QBR)ELECTRONIC TECHNOLOGY CO LTD	MPX	X2, min. 275Vac, 110°C, 1uF	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40047280

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Clause	Requirement – Test	Result – Remark	Verdict

Y-cap (CY4, CY5)	DONG GUAN AJC INDUSTRIAL CO.,LTD	JT	Y1, 2.2nF, 250VAC, 85°C	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40043090
(Alternative)	Macrofar Electronics Technology(HK) Limited	HY	Y1, 2.2nF, 250VAC,85°C	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40050286
(Alternative)	DONGGUAN CITY DERSONIC ELECTRONIC CO LTD	CD	Y1, 2.2nF, 250VAC,85°C	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40040706
(Alternative)	DONGGUAN QINHONG(QBR)ELECTRONIC TECHNOLOGY CO LTD	CT7	Y1, 2.2nF, 250VAC,85°C	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40046285
Opto-coupler (U1,U15)	SHENZHEN ORIENT COMPONENTS CO.,LTD	ORPC817 ORPC817SC	Ext. cr./cl. ≥7.6mm, 110°C	UL 1577	VDE 40029733
(Alternative)	EVERLIGHT ELECTRONICS CO., LTD	EL817 EL817S1-C	Ext. cr./cl. ≥7.6mm, 110°C	UL 1577	VDE 132249
Bridge resistor (R36, R37, R38, R96, R97, R98, R99, R103, R104, R105, R106, R144, R146, R147, R156, R160, R170, R172, R177, R178, R182, R183, R184, R185)	Interchangeable	Interchangeable	3.3MΩ, 0805	--	--
Y-cap (CY1, CY3,CY8)	Prosperity Dielectrics CO., Ltd	FH series	1nF, 250V, Y2 125°C	UL 60384-14 CAN/CSA-E60384-1 (2003)	VDE 40054407

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Clause	Requirement – Test	Result – Remark	Verdict

(Alternative)	HOLY STONE ENTERPRISE CO.,LTD	SCC1808N102#302T	1nF, 250V, Y2 125°C	UL 60384-14 CAN/CSA-E60384-1 (2003)	TUV RH Cert. No.: MK 69241396
MOSFET (Q3, Q9, Q15, Q17)	Interchangeable	Interchangeable	650V 60A	--	--
MOSFET (Q5, Q6, Q7, Q8)	Interchangeable	Interchangeable	100V 150A	--	--
MOSFET (Q21, Q22, Q24, Q25)	Interchangeable	Interchangeable	60V 380mA	--	--
MOSFET (Q13, Q14, Q7, Q8)	Interchangeable	Interchangeable	100V 150A	--	--
Power board output wire to BMS board	DONGGUAN YIAO ELECTRONICS CO LTD	3512	3000V, 200°C, 10AWG	UL 758 CSA-C22.2 No. 127	UL E348933
(Alternative)	Interchangeable	Interchangeable	3000V, 200°C, 10AWG	UL 758 CSA-C22.2 No. 127	UL
Power board output wire to secondary board SYD-N029-PV	DONGGUAN YIAO ELECTRONICS CO LTD	3512	3000V, 200°C, 16AWG	UL 758 CSA-C22.2 No. 127	UL E348933
(Alternative)	Interchangeable	Interchangeable	3000V, 200°C, 10AWG	UL 758 CSA-C22.2 No. 127	UL
Transformer (T4)	Shenzhen Hicoil Electronic Co., Ltd	SYD-N029-BYQ-110-2	Class B, 130°C	--	Test with appliance
- Bobbin	CHANG CHUN PLASTLCS CO.,LTD	T375HF	PMC, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E59481
(Alternative)	SUMIOMO BAKELITE(NANTONG)CO.,LTD	PM-9630	Phenolic, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E41429

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Clause	Requirement – Test	Result – Remark	Verdict

-Winding	ZHEJIANG HONGBO TECHNOLO CO.,LTD	xUEW@/155	155°C	UL 1446	UL E221719
(Alternative)	SHENZHEN JINMA NEW MATERIALS TECHNOLOGY CO.,LTD	UEW/180@	180°C	UL 1446	UL E514717
(Alternative)	Interchangeable	Interchangeable	Min. 155°C	UL 1446	UL
-Tape	SUZHOU MATLADUONA ELECTRIC MATERIAL CO.,LTD	JY313	130°C	UL 510	UL E188295
(Alternative)	SHENZHEN GUNGYE ELECTRONICS TECHNOLOGY CO.,LTD	511/519	200°C	UL 510	UL E309332
-Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200°C	UL 224	UL E156256
-Varnish	ZHUHAI CHANGXIAN CHEMICAL TECHNOLOGY CO.,LTD	E962	130°C	UL 1446	UL E335405
Transformer (T3, T5)	Shenzhen Hicoil Electronic Co., LTD	SYD-N029-BYQ-4	Class B, 130°C	--	Test with appliance
- Bobbin	CHANG CHUN PLASTLCS CO.,LTD	T375HF	PMC, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E59481

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Clause	Requirement – Test	Result – Remark	Verdict

-Winding (Triple insulation wire)	SHENZHEN KAIZHONG HEDONG NEW MATERLAL	TIW-B	130°C	UL 2353	UL E35240
(Alternative)	SHENZHEN DARUN SCIENCE AND TECHNOLOGY CO.,LTD	DRTIW-B	130°C	UL 2353	UL E335841
-Tape	SUZHOU MAILADUONA ELECTRIC MATERIAL CO.,LTD	JY313	130°C	UL 510	UL E188295
-Varnish	ZHUHAI CHANGXIAN CHEMICAL TECHNOLOGY CO.,LTD	E962	130°C	UL 1446	UL E335405
Transformer T2	Shenzhen Hicoil Electronic Co., Ltd	SYD-N029-BYQ-3	Class B, 130°C	--	--
-Bobbin	CHANG CHUN PLASTLCS CO.,LTD	T375HF	PMC, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E59481
(Alternative)	SUMITOMO BAKELITE CO.,LTD	PM-9820	Pehnolic, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E41429
-Winding	HUIZHOU DENGGAODA ELECTROTECH CO.,LTD	X UEWF/ 155	155°C	UL 1446	UL E253843
(Alternative)	SHANTOU SHENGANG ELECTRICAC INDUSTRIAL CO.,LTD	X UEWF/155	155°C	UL 1446	UL E239508

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Clause	Requirement – Test	Result – Remark	Verdict

- Insulation tape	SUZHOU MAILADUONA ELECTRIC MATERIAL CO.,LTD	JY313	130°C	UL 510	UL E188295
- Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200°C	UL 224	UL E156256
-Varnish	ZHUHAI CHANGXIAN CHEMICAL TECHNOLOGY CO.,LTD	E962	130°C	UL 1446	UL E335405
Transformer T1	Shenzhen Hicoil Electronic Co., Ltd	SYD-N029-BYQ-2	Class B, 130°C	--	Test with appliance
-Bobbin	CHANG CHUN PLASTLCS CO.,LTD	T375HF	PMC, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E59481
(Alternative)	SUMITOMO BAKELITE CO.,LTD	PM-9820	Pehnolic, min. thickness 0.43mm, 150°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E41429
- Winding	HUIZHOU DENGGAODA ELECTROTECH CO.,LTD	xUEW/155	155°C	UL 1446	UL E253843
(Alternative)	SHANTOU SHENGANG ELECTRICAC INDUSTRIAL CO.,LTD	xUEW/155	155°C	UL 1446	UL E239508
- Insulation tape	SUZHOU MATLADUONA ELECTRIC MATERIAL CO.,LTD	JY313	130°C	UL 510	UL E188295

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Clause	Requirement – Test	Result – Remark	Verdict

- Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200°C	UL 224	UL E156256
-Varnish	ZHUHAI CHANGXIAN CHEMICAL TECHNOLOGY CO.,LTD	E962	130°C	UL 1446	UL E335405
Transformer (TX3)	Shenzhen Hicoil Electronic Co., Ltd	Uu1015	Class B, 130°C	--	--
-Bobbin	Chang Chun Plastics Co., Ltd	4130	PBT, min. 0.38mm thickness, 140°C	UL 94, UL 746C CSA-C22.2 No. 0.17	UL E59481
-winding	HUIZHOU DENGGAODA ELECTROTECH CO.,LTD	xUEW/155	155°C	UL 1446	UL E253843
(Alternative)	SHANTOU SHENGANG ELECTRICAC INDUSTRIAL CO.,LTD	xUEW/155	155°C	UL 1446	UL E239508
Plastic panel between power board and BMS board.	ZHEN JIANG CHI MEI CHEMICAL CO LTD	PC-540(Y)	PC/ABS, min. 1.5 mm thick, rated V-0, 80°C (RTI)	UL94, UL746C, CAN/CSA C22.2 No. 0.17	UL E194560
Secondary board (SYD-N029-PV)					
Line choke (L3, L4)	Shenzhen Motto technology CO.,LTD	MT106125-400Y-2P-PT-W-X-X	180°C	--	--
-winding	TAI-I ELECTRIC WIRE & CABLE CO LTD	EIW, SMEIW	180°C	UL 1446	UL E85640
BMS board (SYD-N029-BMS)					

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Clause	Requirement – Test	Result – Remark	Verdict

MOSFET (Q37, Q38, Q28, Q35, Q34, Q36, Q40, Q33, Q31, Q30, Q46, Q45)	Interchangeable	Interchangeable	100V, 150A	--	--
NTC (NTC1,NTC3,NTC5,NTC9,NTC12)	Nanjing Shiheng Electronic Technology Co. , Ltd.	XGPUS	10k 1%	UL 1434 UL 60730-1	UL E502869
(Alternative)	GUANGZHOU NEWLIFE MAGNE ELECTRICITY CO.,LTD	NL103F3435	10k 1%	UL 1434 UL 60730-1	UL E505719
Fuse (F1, F2, F3)	Asiacom technology Ltd	S1032-F-40.0A	72V, 40A	UL 248-1 UL 248-14 CSA-C22.2 No. 248-1-00	UL E10480
Output connector					
PV charging connector	GUANGDONG WEIPU ELECTRICAL APPLIANCE CO LTD	SA20	150V, 12A	--	--
(Alternative)	Interchangeable	Interchangeable	150V, 12A	--	--
AC inlet	LECI Electronics Co., LTD	DB-14	250V, 15A	UL 498 UL 60320-1	UL E302229
Cigarette Lighter Socket	Dong guan liu shi electronics CO.,LTD	D type	12V, 10A	--	--
USB port	Dongguan SenYi	USB AF	5Vdc, 3A	--	--
(Alterntive)	Shenzhen Brixine Electronics Co. LTD	USB AF	5Vdc, 3A	--	--

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Clause	Requirement – Test	Result – Remark	Verdict

Type C port	DONGGUAN SHENGKUN ELECTRONICS TECHNOLOGY	TYPE C	20Vdc, 3A	--	--
DC 5521 output port	Huizhou WS Electronic Technology Co Ltd	5521JL80	12Vdc, 3A	--	--
XT60 connector	CHANGZHOU AMASS ELECTRONICS CO.,LTD	XT60UPB-M	500V, 35A	UL 1977	UL E482722
Rechargeable Lithium-ion Cell	EVE POWER Co., Ltd.	C40	3.2Vdc, 20Ah, 64Wh	UL 1642	UL MH28717
Supplementary information:					
1) Provided evidence ensures the agreed level of compliance.					

Attachment 1

Photo Documentation

PHOTO 1: Overall view

PHOTO 2: External view

PHOTO 3: External view

PHOTO 4: External view

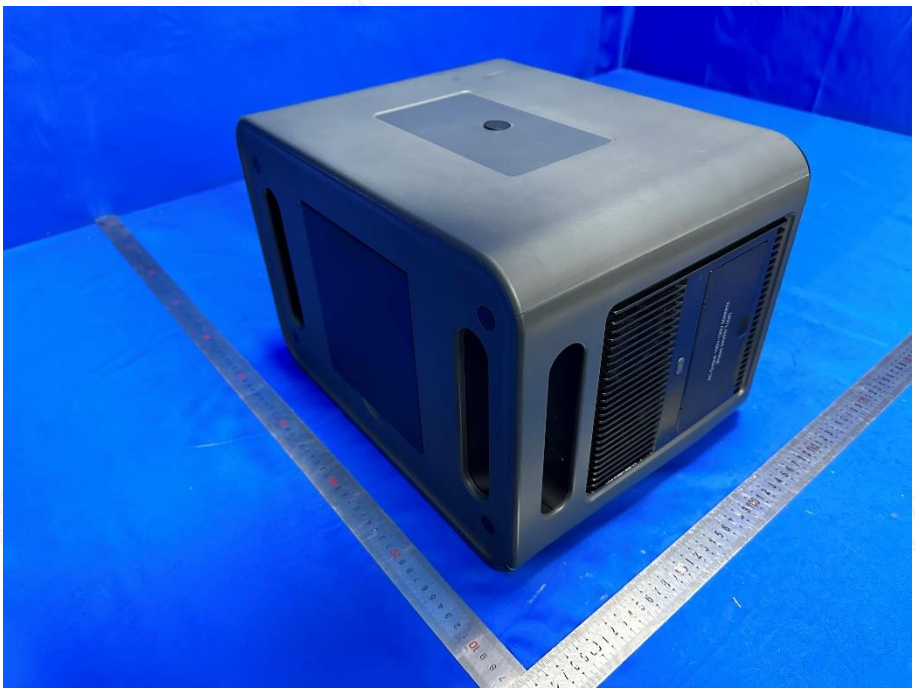


PHOTO 5: External view

PHOTO 6:External view

PHOTO 7: Internal view

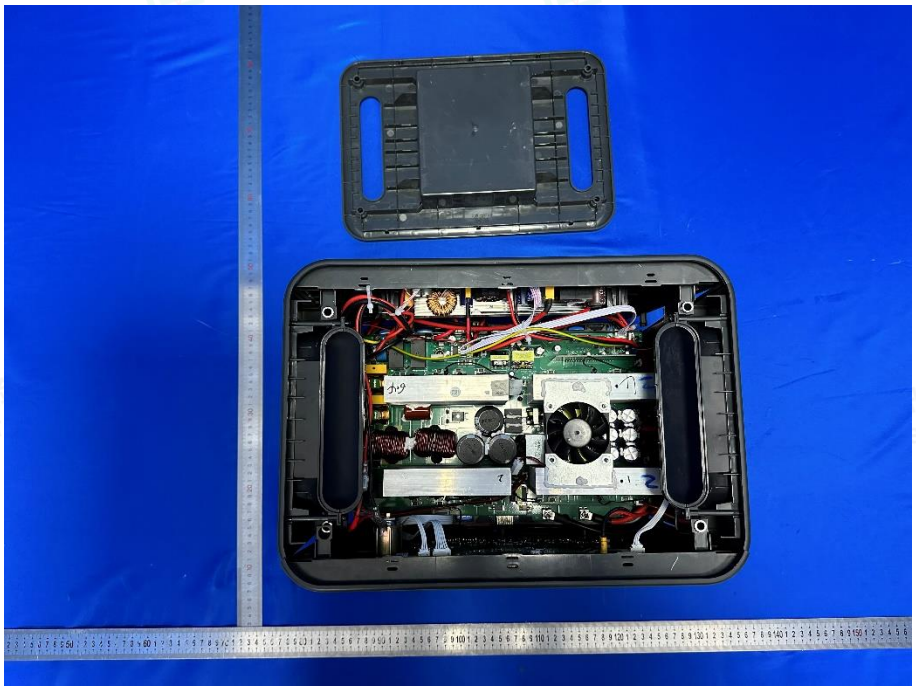


PHOTO 8: Internal view

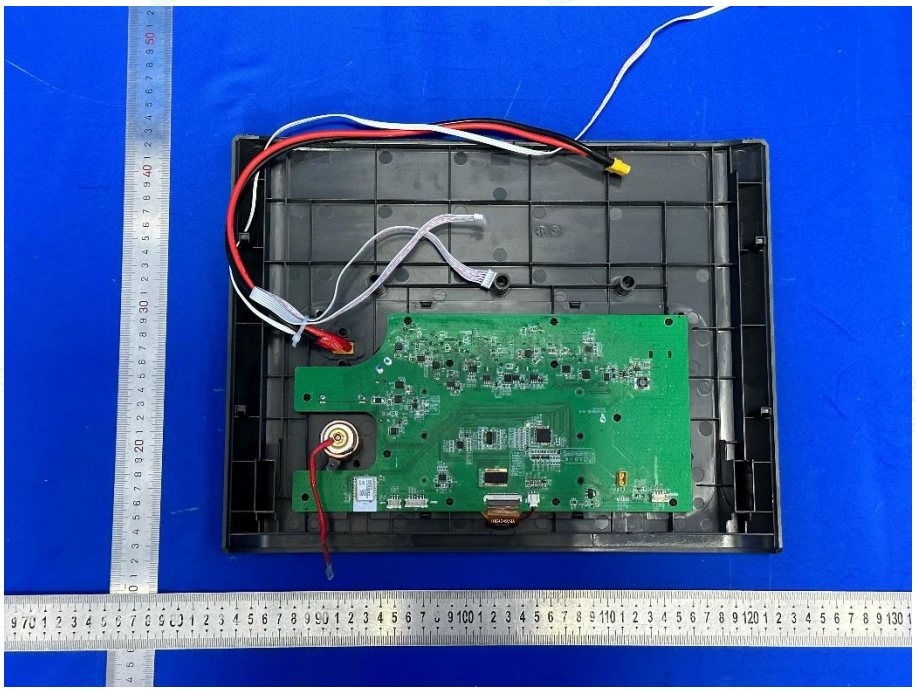


PHOTO 9: Internal view

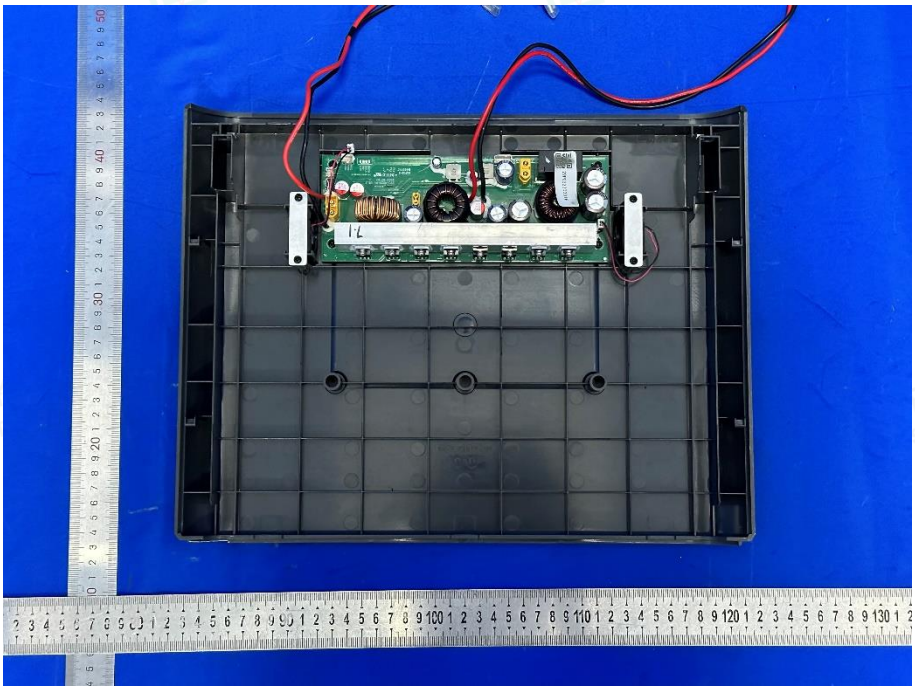


PHOTO 10: Internal view

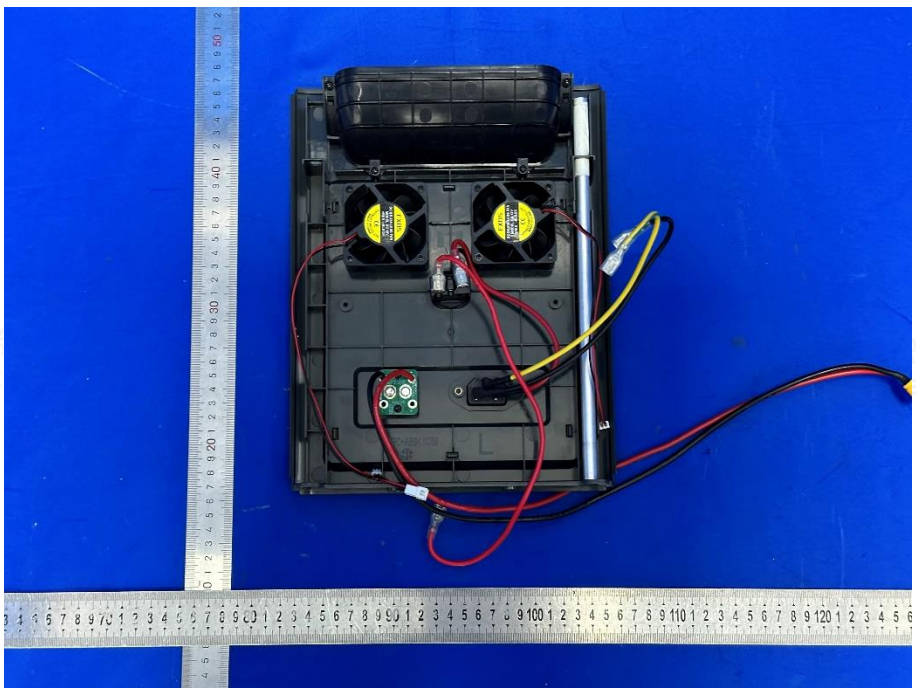


PHOTO 11: Internal view

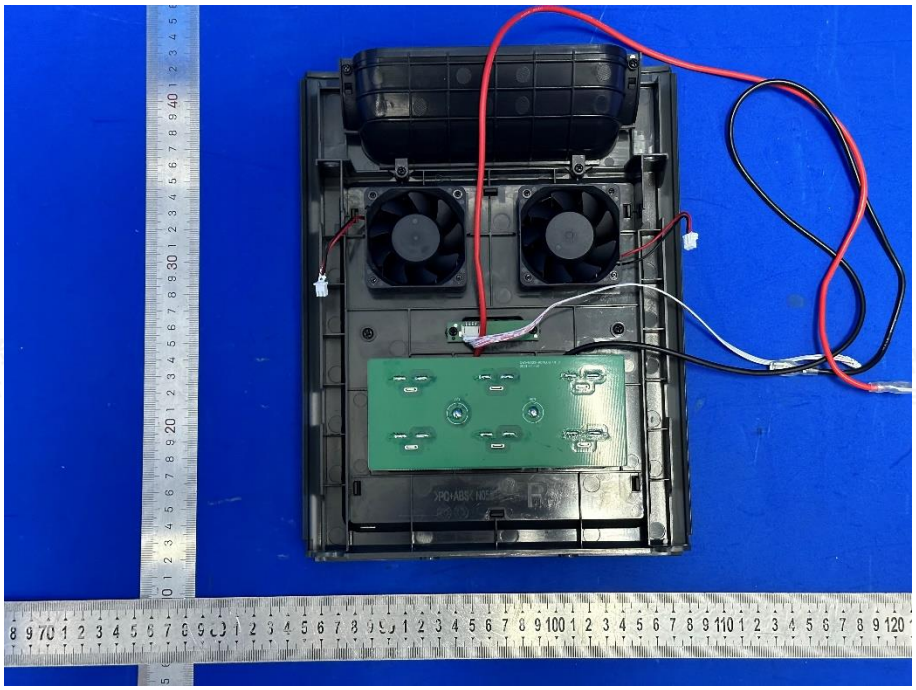


PHOTO 12: PCB view

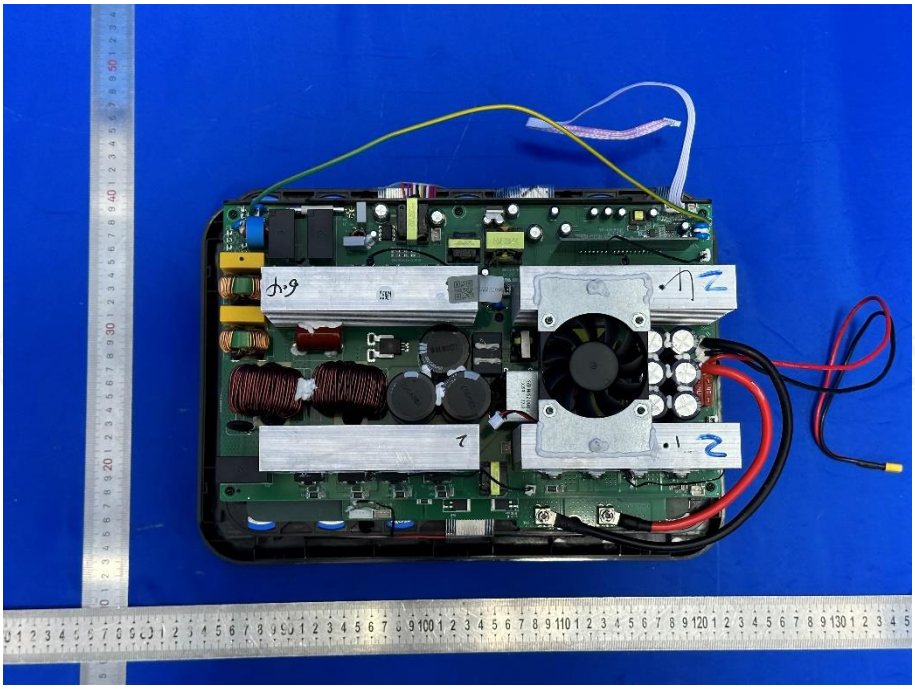


PHOTO 13: PCB view

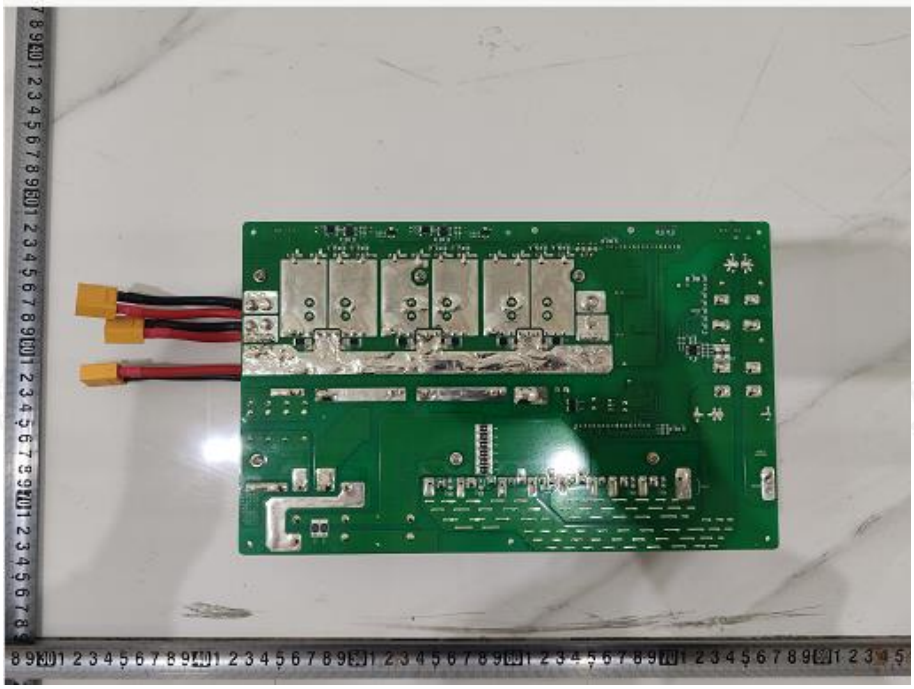


PHOTO 14: Internal view

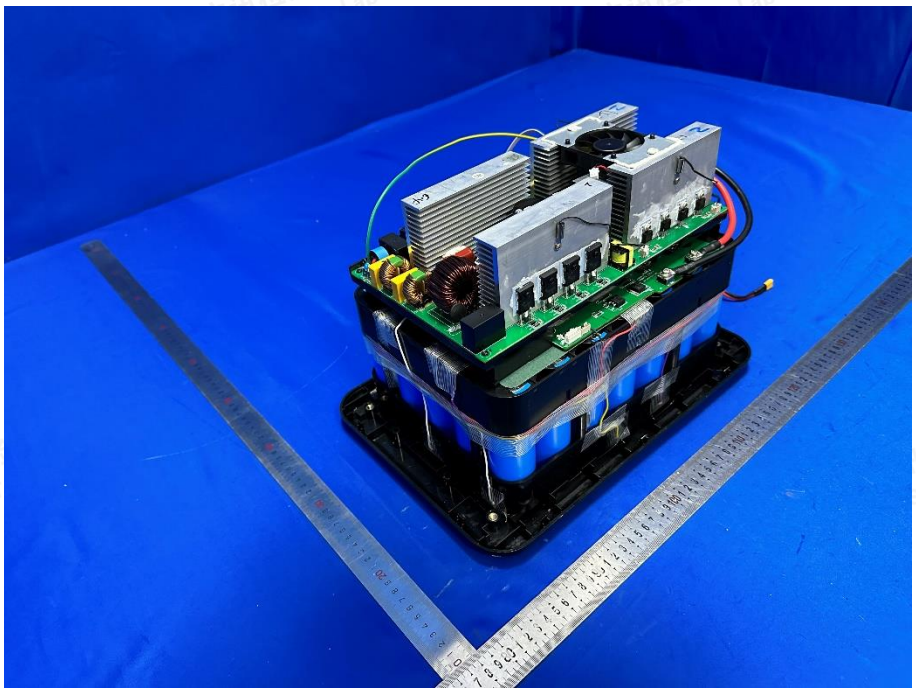


PHOTO 15: PCB view

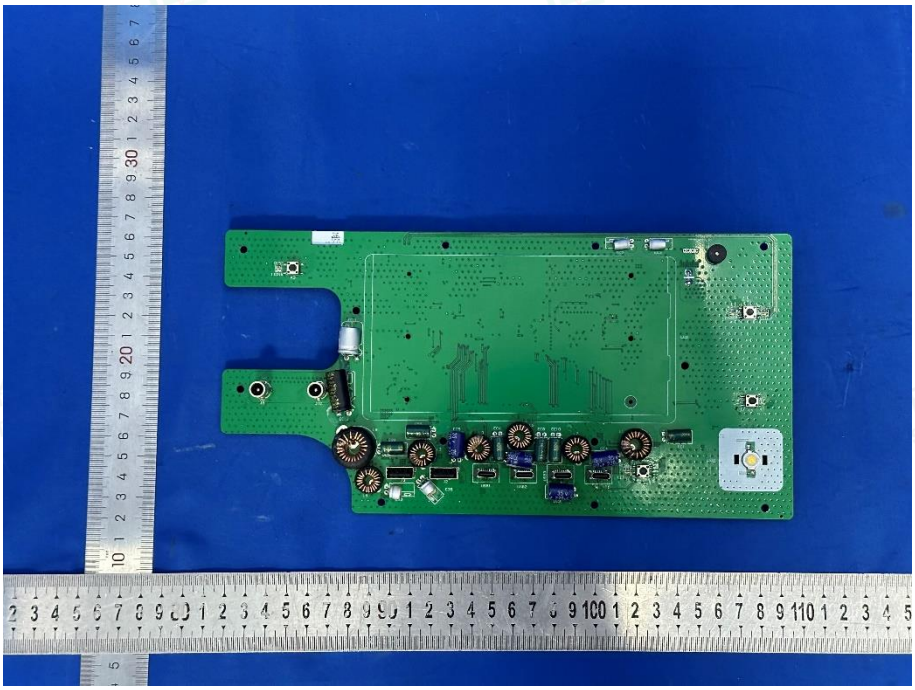


PHOTO 16: PCB view

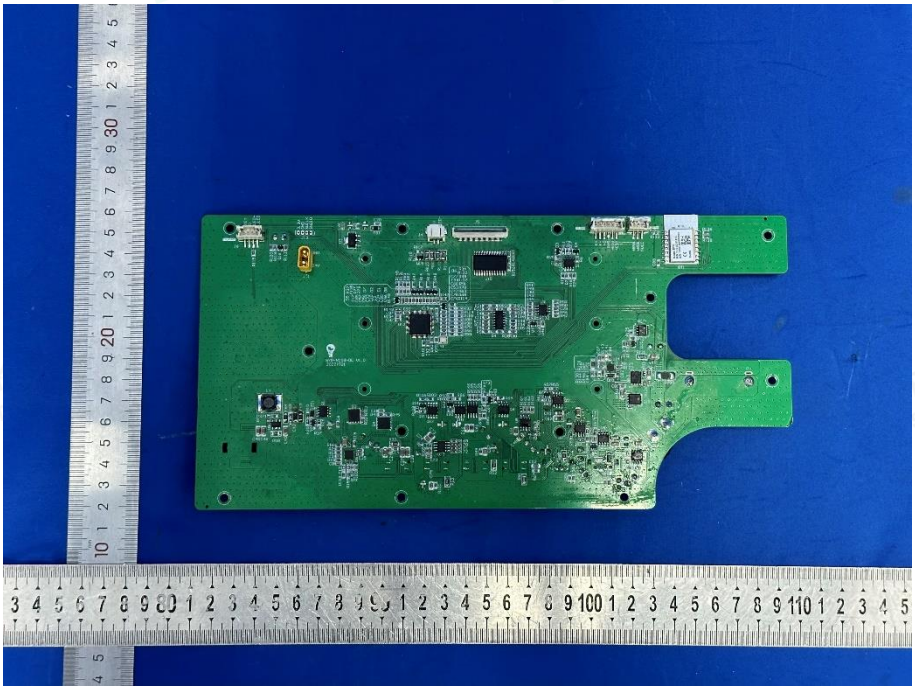


PHOTO 17: PCB view

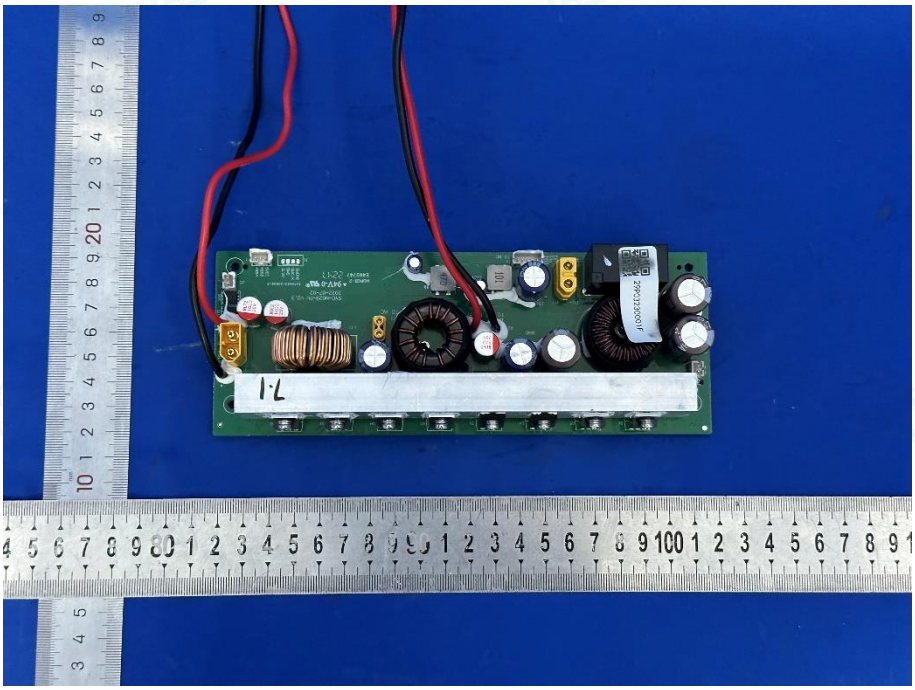


PHOTO 18: PCB view

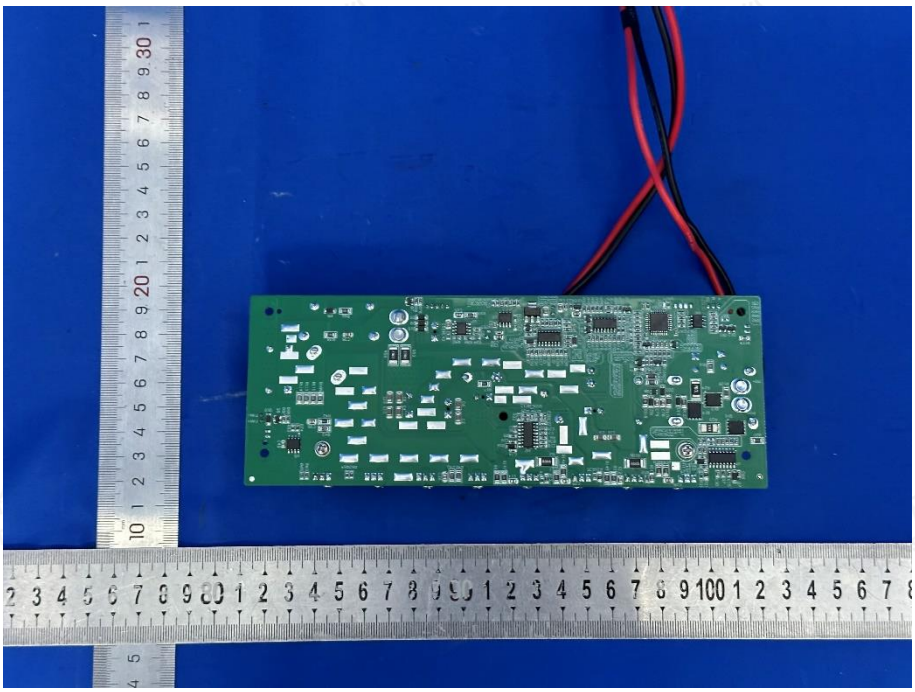


PHOTO 19: PCB view

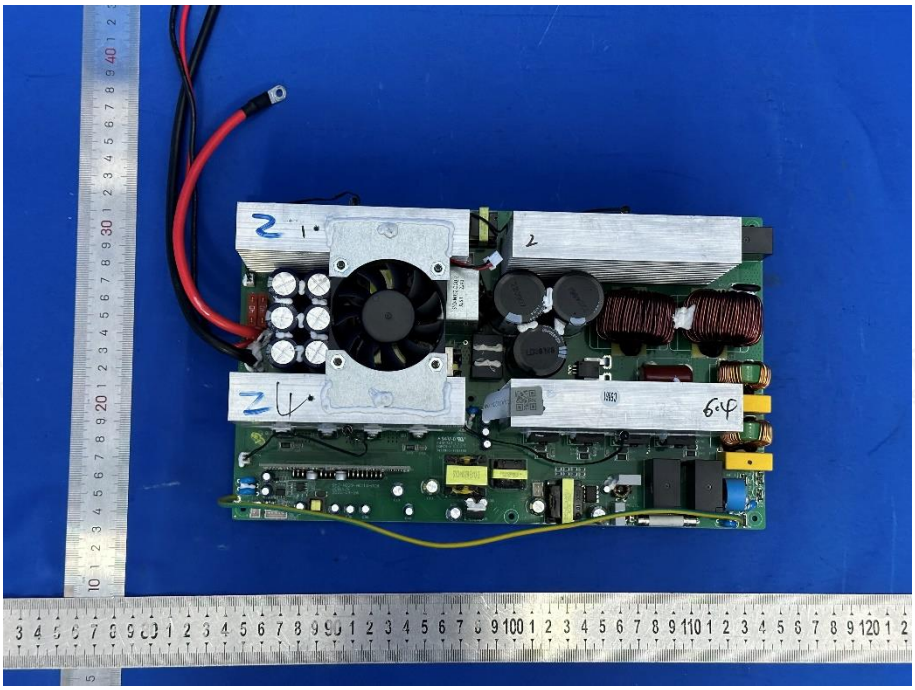


PHOTO 20: PCB view

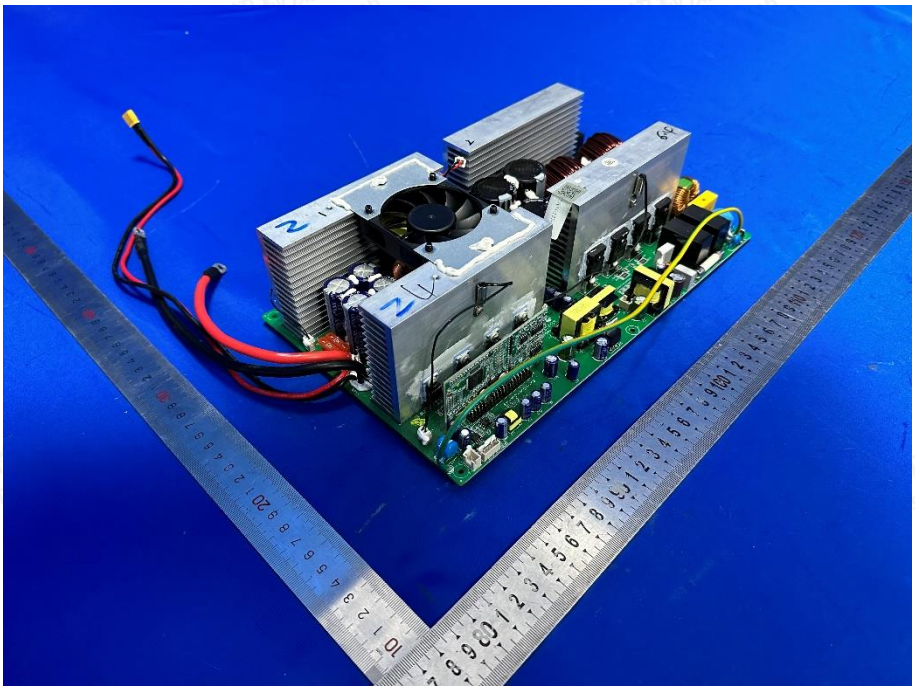


PHOTO 21: PCB view

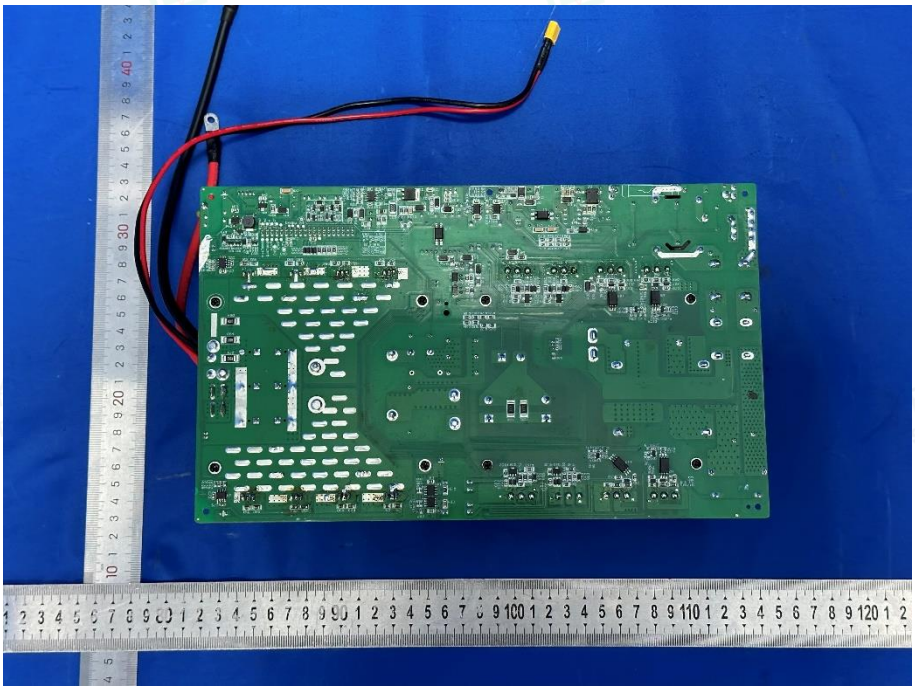


PHOTO 22: Internal view

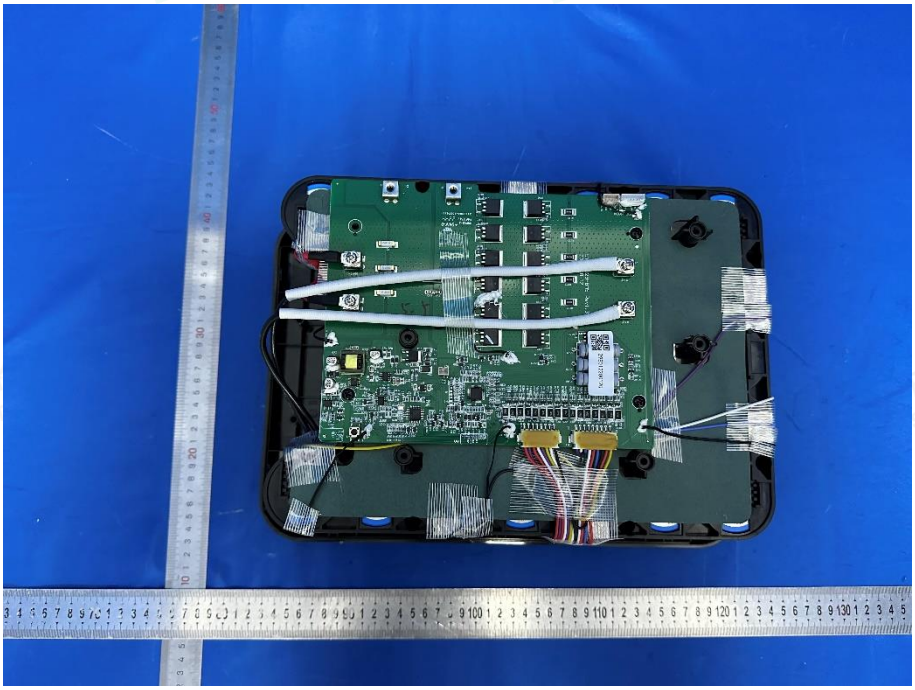


PHOTO 23: Battery view

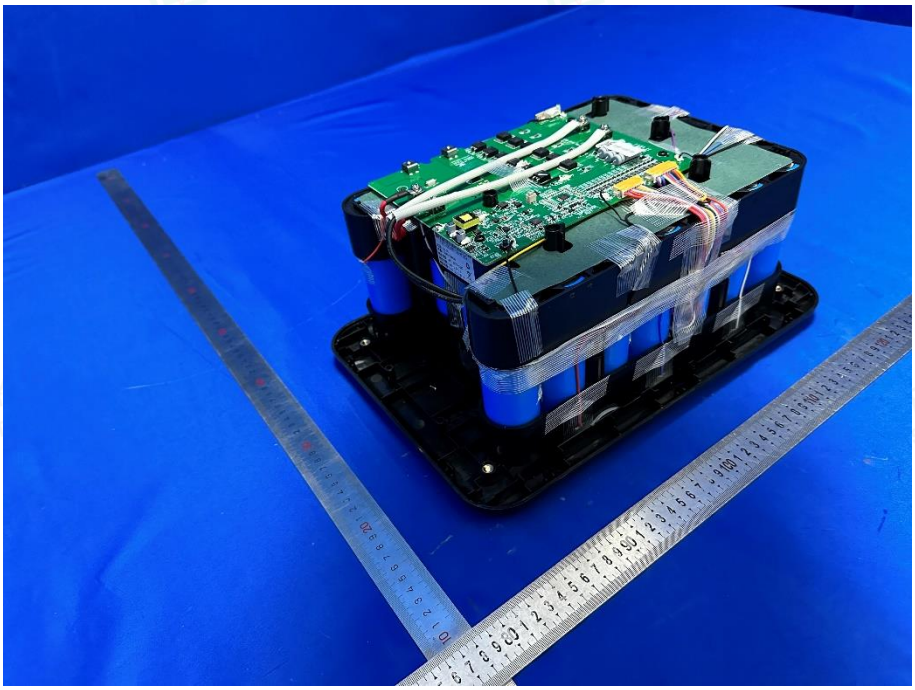
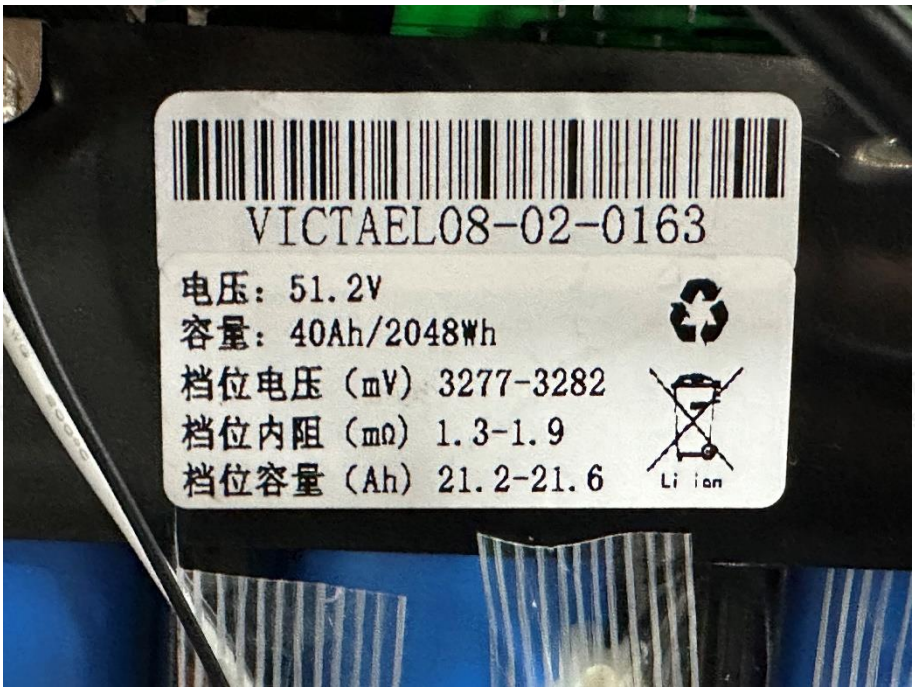


PHOTO 24: Battery label view



--END OF THE TEST REPROT--