

TEST REPORT UL 2272 Survey outline of electrical system of self-balancing scooter	
Report Number.....:	S03A26051066U00101R1
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Applicant.....:	Yongkang Weidasheng Vehicle Industry Co., Ltd.
Address.....:	Floors 6-7, Building2, No.366 HuachuanRoad, Xicheng Substrict, Yongkang City, Jinhua City, Zhejiang Province, China
Test specification:	
Standard.....:	ANSI/CAN/UL2272: 2024
Test item description.....:	Transportation scooter
Trade Mark.....:	N/A
Manufacturer.....:	Yongkang Weidasheng Vehicle Industry Co., Ltd.
Address.....:	Floors 6-7, Building2, No.366 HuachuanRoad, Xicheng Substrict, Yongkang City, Jinhua City, Zhejiang Province, China
Factory.....:	Yongkang Weidasheng Vehicle Industry Co., Ltd.
Address.....:	Floors 6-7, Building2, No.366 HuachuanRoad, Xicheng Substrict, Yongkang City, Jinhua City, Zhejiang Province, China
Model/Type reference.....:	Y3
Ratings.....:	Maximum speed: 6km/h Load Weight: 150kg; Rating: 12V, 12Ah, 144Wh



List of Attachments (including a total number of pages in each attachment): N/A		
Summary of testing:		
Tests performed (test clause and name of test):		
Done	Test Name	Clause
	ELECTRICAL TESTS	--
	Overcharge Test	24
X	Short Circuit Test	25
	Overdischarge Test	26
X	Temperature Test	27
	Imbalanced Charging Test	28
	Dielectric Voltage Withstand Test	29
	Isolation Resistance Test	30
	Leakage Current Test	31
	Grounding Continuity Test	32
	MECHANICAL TESTS	--
X	Vibration Test	33
X	Shock Test	34
X	Crush Test	35
X	Drop Test	36
X	Mold Stress Relief Test	37
X	Handle Loading Test	38
X	Motor Overload Test	39
X	Motor Locked Rotor	40
	Strain relief pull test	41.2
	Push-back test	41.3
	ENVIRONMENTAL TESTS	--
	IPX4 Code rating	42.1
	Partial immersion	42.2
X	Thermal Cycling Test	43
	Label Permanence Test	44

Possible test case verdicts:

- test case does not apply to the test object..... : N/A (Not Applicable)
- test object does meet the requirement..... : P (Pass)
- test object does not meet the requirement..... : F (Fail)

Testing.....:

Date of receipt of test item..... : 2026-06-05

Date (s) of performance of tests..... : 2026-06-05~2026-06-23

General remarks:

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

General product information and other remarks:

Important Test Parameters:

Charger:	Certificate Number :UL-US-2325179-0	Personal e-mobility device:	X
Model No.	HG8S240200	Type of Device	--
Manufacturer	Zhejiang Hengao Electronics Co., Ltd.	Model No.	Y3
Input Voltage Rating	100-240V, 50/60HZ	Manufacturer	Personal E-Mobility Devices
Output Voltage Rating:	27.2V	Electrical Ratings (volts, current and/or power)	Rating: 12Vdc, 12Ah
Input Current Rating	1.5A	Weight of device, kg	--
Output Current Rating	2A	Max Weight Limit, kg	150kg
MOTORS:	X	Max Speed, km/h	6km/h
Manufacturer	Zhejiang Gaosheng Electromechanical Co., Ltd.	IP rating	--
Model No.	7012-2	Specified maximum angle of operation	--
Motor Type	DC brushless / one	Provided with Handle (s)	--
Insulation Class	--	Specified operating ambient range, C	0-40°C
Specified Voltage	24V	Specified charging ambient range, C	-10-45°C
Specified Current/Wattage	300W	--	--

Note 1: This sample comes in multiple colors.

Note 2: This report is based on S03A26051066U00101. Only the report template has changed; the battery itself is exactly the same as the product in the previous test report. According to engineering judgment, no additional tests need to be considered for this report, and the original report S03A26051066U00101 is void.

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
CONSTRUCTION			
7	NON-METALLIC MATERIALS		P
7.1	The materials employed for enclosures relied upon for safety per 6.14 shall comply with the applicable enclosure requirements outlined in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, Path III of the Enclosure Requirements in Table 4.1 or the Standard for Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17, except as modified by this standard.		N/A
7.2	<p>Polymeric materials employed for fire enclosures shall have a minimum flame rating of 94V-1 in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, or the Standard for Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17.</p> <p>Exception: The enclosure may alternatively be evaluated to the 20 mm end product flame test in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, or the Standard for Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17.</p>		N/A
7.3	<p>The following factors in (a) – (e) are taken into consideration when an enclosure employing nonmetallic materials is being judged. For a nonmetallic enclosure all of these factors are to be considered with respect to thermal aging. Dimensional stability of a polymeric enclosure is addressed by compliance to the mold stress relief test. Suitability to factors (a) – (e) below may be determined by the tests of this standard</p> <p>a) Resistance to impact; b) Crush resistance; c) Abnormal operations; d) Severe conditions; and e) Mold-Stress Relief Distortion.</p>		N/A
7.4	The polymeric materials employed for enclosures and insulation shall be suitable for anticipated temperatures encountered in the intended application. Enclosures shall have a Relative Thermal Index (RTI) with impact suitable for temperatures encountered in the application but no less than 80°C (176°F), as determined in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, or the Standard for Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17.		N/A

ANSI/CAN/UL-2272:2024			
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7.5	The enclosure materials intended to be directly exposed to sunlight and rain in the end use application shall comply with the UV Resistance and the Water Exposure and Immersion tests in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, or the Standard for Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17. This requirement may be waived if the personal e-mobility device is marked that it be stored indoors and user instructions also indicate that it not be left outdoors to be exposed to UV or rain. See 47.11 and Section 48.		N/A
7.6	Materials employed as electrical insulation in the assembly shall be resistant to deterioration that would result in an electrical shock, fire or other safety hazard. Compliance is determined by the tests of this standard. Materials employed for direct support of live parts at hazardous voltage, shall additionally meet the direct support insulation criteria outlined in the Material Property Considerations, Table 6.1, in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C or the Standard for Evaluation of Properties of Polymeric Materials, CAN/CSA-C22.2 No. 0.17, unless employed as part of a component that has been evaluated to a suitable component standard. Insulated wiring is subjected to the requirements outlined in Section 10, Wiring and Terminals.		N/A
7.7	Gaskets and seals relied upon for safety shall be tested in accordance with one of the following: a)UL 157; b)The Gasket Tests in UL 62368-1/CSA C22.2 No.62368-1; or c) The Gasket Tests in UL 50E/CSA C22.2 No. 94.2.		N/A
7.8	Nonmetallic materials used for internal parts within the overall enclosure shall be rated V-2 minimum.		P

ANSI/CAN/UL-2272:2024			
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	<p>Exception: Nonmetallic materials used for internal parts within the overall enclosure of PS2 circuits (power source class 2 requirements outlined in UL 62368-1/CSA C22.2 No. 62368-1) shall comply with one of the following:</p> <p>a) Be mounted on minimum V-1 class material or VTM-1 class material;</p> <p>b) Be constructed of minimum V-2 class material, VTM-2 class material, or HF-2 class foamed material;</p> <p>c) Have a size of less than 1750mm³(0.11 in³);</p> <p>d) Have a mass of combustible material of less than 4g(0.14oz),;</p> <p>e) Be separated by at least 13mm(0.51 in) of air from electrical parts (other than insulated wires and cables) which under fault conditions are likely to produce a temperature that could cause ignition; or</p> <p>f) Be in a sealed enclosure of 0.06m³(2.12ft³) or less, consisting totally of non-combustible material and having no ventilation openings.</p>		P
7.9	Internal parts of components shall comply with the flammability requirements of the component standard in accordance with Components, Section 2		P
7.10	Small parts, and gaskets, that are not located near live parts, and are located in a manner such that they cannot propagate flame from one area to another within the equipment, are not required to have a specific flame rating.		P
7.11	Nonmetallic materials located outside the enclosure, and not used to complete the enclosure, are considered decorative parts. These parts do not have a specified flame rating.		P
7.12	Printed wiring board materials used for circuits or components at hazardous voltage or hazardous energy levels shall be rated V-1 minimum.		N/A
7.13	For the requirements outlined in 7.8 -- 7.12, 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 UL 94 and CSA C22.2 No.0.17.		P
8	METALLIC PARTS RESISTANCE TO CORROSION		P
8.1	Metal enclosures shall be corrosion resistant. A suitable plating or coating process can achieve corrosion resistance. Additional guidance on methods to achieve corrosion protection can be found in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E or in CSA-C22.2 No. 94.2.		P

ANSI/CAN/UL-2272:2024			
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8.2	Metal enclosures may be provided with an insulating liner to prevent shorting of live parts to the enclosure. If using an insulating liner for this purpose, the insulating liner shall consist of non-moisture absorbent materials that have a temperature rating suitable for temperatures during operation including charging		P
8.3	Conductive parts in contact at terminals and connections shall not be subject to corrosion due to electrochemical action..		P

ANSI/CAN/UL-2272:2024			
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9	Enclosures		P
9.1	General		P
9.1.1	The enclosure relied upon for safety per 6.14 shall have the strength and rigidity required to resist the possible physical abuses that it will be exposed to during its intended use, in order to reduce the risk of fire or injury to persons as determined by the requirements contained in this standard.		P
9.1.2	A tool providing the mechanical advantage of a pliers, screwdriver, hacksaw, or similar tool, shall be the minimum mechanical capability required to open the enclosure.		N/A
9.1.3	Openings in the enclosure relied upon for safety per 6.14 shall be designed to prevent inadvertent access to hazards such as hazardous voltages, hazardous moving parts or hot surfaces that could result in burns. Parts that can be removed without the use of a tool, are to be removed to determine compliance. Compliance is determined by Clause 12, Tests for Protection Against Access to Hazardous Parts Indicated by the First Characteristic Numeral, of the Standard for Degrees of Protection Provided by Enclosures (IP Code), IEC 60529, or the Standard for Degrees of Protection Provided by Enclosures (IP Code), CAN/CSA-C22.2 No. 60529, for a minimum IP rating of IP3X. Evaluation per the Standard for Degrees of Protection Provided by Enclosures (IP Code), IEC 60529 or CAN/CSA-C22.2 No. 60529, Clause 12, consists of the use of the Test Rod 2.5 mm, 100 mm long, shown in Figure 1 of the Standard for Batteries for Use In Light Electric Vehicle (LEV) Applications, UL 2271, or CAN/ULC-S2271, applied with a force of 10 N $\pm 10\%$.		N/A
9.1.4	Openings in the environmental enclosure per 6.14 shall be designed to prevent ingress of water as installed in the personal e-mobility device in accordance with intended use and IP rating in accordance with the Standard for Degrees of Protection Provided by Enclosures (IP Code), IEC 60529, or CAN/CSA-C22.2 No. 60529 with a minimum rating of IPX4 and resistant to hazards associated with partial immersion. Compliance is determined by the Water Exposure Tests in Section 42.		N/A
9.2	Battery compartments		P
9.2.1	Cell vents shall not be obstructed in such a way as to defeat their operation if venting is relied upon for compliance with this standard. Compliance is checked by inspection.		P

ANSI/CAN/UL-2272:2024			
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9.2.2	Battery compartments within enclosures shall secure the battery in place sufficiently to prevent excessive movement and stress on the battery and cells that could result in a hazard. Compliance is checked by inspection and the mechanical tests of this standard.		P
9.2.3	To prevent user servicing such as cell replacement, the outer enclosure of the battery shall be designed such that it is not capable of being opened using simple tools, such as a screwdriver. The enclosure shall be ultrasonically welded or secured by equivalent means. Adhesives complying with the adhesive requirements of UL 746C, single use or tamper-proof screws are considered equivalent means. Exception: The requirement can be replaced by any easily detectable means for a new opening, for example a broken seal. The manufacturer shall remind users not to use a product with broken seals and shall be immediately forwarded for appropriate recycling.		P
9.2.4	To prevent user servicing such as cell replacement when the device enclosure serves as the outer enclosure of the battery, the device enclosure shall be designed such that it is not capable of being opened using common household tools, such as a flat blade or Philips head screwdriver. The enclosure shall be ultrasonically welded or secured by equivalent means. Adhesives complying with the adhesive requirements of UL 746C, or single use or tamper-proof screws, are considered equivalent means. See 47.12 and 48.4.		P
10	Wiring and Terminals		P
10.1	Wiring shall be insulated and acceptable for the purpose, when considered with respect to temperature, voltage, and the conditions of service to which the wiring is likely to be subjected within the equipment.		P
10.2	Internal wiring shall be routed, supported, clamped or secured in a manner that reduces the likelihood of excessive strain on wire and on terminal connections; loosening of terminal connections; and damage of conductor insulation. In safety critical circuits, for soldered terminations, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering alone to maintain the conductor in position. Wire routing shall not result in undue stress on battery cells in fully assembled products.		P
10.3	Connections to the cells shall be made in a manner that does not result in damage to the cells. For example, connections made using high heat processes such as solder shall not be used on direct connections to the cell terminals without proper processes and controls as this could result in damage to the cell as a result of heat transfer during soldering.		P

ANSI/CAN/UL-2272:2024			
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10.4	An external terminal shall be designed to prevent an inadvertent shorting and misalignment and a reverse polarity connection when connections are made. For battery packs that are intended for removal from the personal e-mobility device for external charging or replacement with a charged battery pack, the external terminal for discharging shall be designed to prevent inadvertent shorting, a reverse polarity connection and a misalignment.		P
10.5	For battery packs that are intended for removal from the personal e-mobility device for external charging or replacement with a charged battery pack by the user, the external terminal for discharging and any other external terminals with hazardous voltage shall be designed to prevent access by the user. Compliance is determined by use of the articulate test finger shown in Figure 10.1.		N/A
10.6	The external terminals of a battery pack with hazardous voltage circuits that is intended for removal from the personal e-mobility device for charging, shall be evaluated to either the no load endurance test or endurance with load test as applicable to the end use application in accordance with the Standard for Plugs, Receptacles, and Couplers for Electric Vehicles, UL 2251, or the Standard for Plugs, Receptacles, and Couplers for Electric Vehicles, CAN/CSA C22.2 No. 282, without being subjected to the exposure to contaminants.		N/A
10.7	A hole by which insulated wires pass through a metal wall shall be provided with a smoothly rounded bushing or shall have smooth surfaces, free of burrs, fins, sharp edges, and the like, upon which the wires may bear, to prevent abrasion of the insulation.		P
10.8	Wiring for hazardous voltage shall be enclosed in an electrical enclosure with hazardous voltage warning labels such as ISO 7010, No. W012 (i.e. lightning bolt within triangle).		N/A

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11	Chargers		N/A
11.1	Power supplies intended for charging the personal e-mobility device shall be evaluated for intrinsic safety in accordance with the Standard for Class 2 Power Units, UL 1310, or the Standard for Power Supplies with Extra-Low-Voltage Class 2 Outputs, CSA-C22.2 No. 223, the Standard for Power Units other than Class 2, UL 1012, or the Standard for General Use Power Supplies, CSA-C22.2 No. 107.1, the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, or CAN/CSA-C22.2 No. 60950-1, or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1, or CAN/CSA-C22.2 No. 62368-1, and shall be determined compatible with the device's battery system. Compliance is determined by a review of data on the battery system and charger and the tests of this standard. The charger shall be provided with a means for connection to a standard outlet if intended for connection to a mains source of electrical supply in accordance with the standards noted above.	Certificate Number: UL-US-2325179-0	N/A
11.2	The connector provided with the charger for connecting to the personal e-mobility device/battery terminal for charging, shall be designed to prevent misalignment and reverse polarity or electrical mismatch. Compliance is checked by inspection of the connector design, and if necessary, the Protective Circuits and Safety Analysis requirements in Section 16.		N/A

ANSI/CAN/UL-2272:2024			
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12	Fuses		N/A
12.1	Fuses shall be acceptable for the current and voltage of the circuit they are protecting.	No user replaceable fuses	N/A
12.2	For user replaceable fuses, a fuse replacement marking shall be located adjacent to each fuse or fuse holder, or on the fuse holder, or in another location provided that it is obvious to which fuse the marking applies, and giving the fuse ratings. Where user replaceable fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated. Information on proper fuse replacement of user replaceable fuses shall also be included in the instructions.		N/A
13	Lighting		N/A
13.1	An integral lamp shall be rated for the application. If provided with user replaceable bulbs, replacement shall not impair the safety of the personal e-mobility device and there shall be no risk of electric shock. Instructions provided with the personal e-mobility device shall include information on the type and ratings of user replaceable bulbs.	No user replaceable bulbs	N/A
14	Electrical Spacings and Separation of Circuits		P
14.1	Electrical circuits within the personal e-mobility device at opposite polarity shall be provided with reliable physical spacing to prevent inadvertent short circuits (i.e. electrical spacings on printed wiring boards, physical securing of uninsulated leads and parts, etc.). Insulation suitable for the anticipated temperatures and voltages shall be used where spacings cannot be controlled by reliable physical separation.		P
14.2	a) Electrical spacings in circuits shall have the following minimum over surface and through air b) spacings as outlined in one of the following: c) Table 14.1; d) The spacings requirements outlined in UL 60950-1 /CSA C22.2 No.60950-1, in Clearances, e) Creepage Distances and Distances Through Insulation; or f))The spacing requirements outlined in UL 62368-1 /CSA C22.2 No.62368-1.		P

ANSI/CAN/UL-2272:2024			
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	<p>g) Exception No. 1: As an alternative to the spacing requirements of Table 14.1, the spacing requirements in</p> <p>h) UL 840, or CSA C22.2 No. 0.2. may be used. For determination of clearances, a dc source such as a</p> <p>i) battery does not have an overvoltage category as outlined in UL 840 or CSA C22.2 No. 0.2, unless</p> <p>j) charged through a source connected to a mains supply. The anticipated pollution degree is determined by</p> <p>k) the design underevaluation.</p>		P
	<p>l) Exception No. 2: As an alternative to the clearance values outlined in UL 60950-1 / CSA C22.2 NO</p> <p>m) 60950-1, Clearances, Creepage Distances and Distances Through Insulation, the alternative method for</p> <p>n) determining minimum clearances in the Annex for Alternative Method for Determining Minimum</p> <p>o) Clearances of UL 60950-1/CSA C22.2 No.60950-1, may be applied.</p>		P
14.3	There are no minimum spacings applicable to parts where insulating compound completely fills the casing of a component or subassembly if the distance through the insulation, at voltages above 60 Vdc or above 30 Vrms is a minimum of 0.4-mm (0.02-in) thick for supplementary or reinforced insulation, and passes the Dielectric Voltage Withstand Test, Section 29, and the Isolation Resistance Test, Section 30. There is no minimum insulation thickness requirement for insulation of circuits at or below 60Vdc or for basic or functional insulation. Some examples include potting, encapsulation, and vacuum impregnation.	Less than 60Vdc	P
14.4	Conductors of circuits operating at different voltages shall be reliably separated from each other through the use of mechanical securements such as barriers or wire ties to maintain spacing requirements unless they are each provided with insulation acceptable for the highest voltage involved. An insulated conductor shall be reliably retained so that it cannot contact an uninsulated live part of a circuit operating at a different voltage.		P
15	Insulation Levels and Protective Grounding		P
15.1	Hazardous voltage circuits shall be insulated from accessible conductive parts and safety extra low voltage (SELV) circuits as outlined in 15.2 through the following:	No Hazardous voltage circuits	N/A

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
	a) Basic insulation and provided with a protective grounding system for protection in the event of a fault of the basic insulation; or b) A system of double or reinforced insulation; or c) A combination of (a) and (b).		N/A
15.2	Safety extra low voltage (SELV) circuits (i.e. circuits at or below 60 Vdc or 48 Vrms under normal and single fault conditions) that are insulated from accessible conductive parts through functional insulation only are considered accessible.		P
15.3	If relying upon a protective grounding system (i.e. grounding of an accessible metal enclosure), it shall comply with 15.4 – 15.6.		N/A
15.4	Parts of a protective grounding system shall be reliably secured in accordance with 10.2 and provided with good metal-to-metal contact of the grounded parts of the personal e-mobility device. The impedance from the various bonding conductors and connections to the main ground terminal shall have a maximum resistance of 0.1 Ω . Compliance can be determined by measurement using an ohmmeter.		N/A
15.5	The main ground terminal of the protective earthing ground system shall be identified by one of the following: a) A green-colored, not readily removable terminal screw with a hexagonal head; b) A green-colored, hexagonal, not readily removable terminal nut; c) A green colored pressure wire connector; or d) The word "Ground" or the letters "G" or "GR" or the grounding symbol (IEC 60417, No. 5019 – upside down "tree" in circle) or otherwise identified by a distinctive green color. For Canada only use the grounding symbol rather than the words "Ground", or "G" or "GR".		N/A
15.6	Conductors, relied upon for the protective grounding and bonding system, shall be sized to handle intended fault current. If insulated, the insulation shall be green or green and yellow striped in color.		N/A
16	Protective Circuits and Safety Analysis		N/A

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
16.1	The personal e-mobility device's protective circuitry shall maintain the cells within their specified operating region for charging and discharging through the life of the device. If cell specified operating limits are exceeded, the protective circuitry shall limit or shut down the charging or discharging to mitigate excursions beyond specified operating limits. Compliance is determined through a review of the cell specifications and safety analysis of 16.2 and through the testing of this standard. If applicable to the personal e-mobility device design, the analysis and testing needs to evaluate the overcharge protection control's ability to mitigate overcharge due to regenerative charging during use.		N/A
16.2	An analysis of potential electrical and energy hazards (including an FMEA) shall be conducted the personal e-mobility device's electrical system to determine that events that could lead to a hazardous condition have been identified and addressed through design or other means. Documents that can be used as guidance for the safety analysis include:		N/A
	a) The Standard for Analysis Techniques for System Reliability – Procedure for Failure Mode and Effects Analysis (FMEA), IEC 60812; b) The Standard for Fault Tree Analysis (FTA), IEC 61025; c) The Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA), SAE J1739; or d) The Procedures for Performing a Failure Mode, Effects, and Criticality Analysis, MIL-STD- 1629A.		N/A
16.3	The analysis in 16.2 is utilized to identify anticipated faults in the system which could lead to a hazardous condition and the types and levels of protection provided to mitigate the anticipated faults. The analysis shall consider single fault conditions in the protection circuit/scheme as part of the anticipated faults		N/A
16.4	When conducting the analysis of 16.2, active devices shall not be relied upon for critical safety unless: a) They are provided with a redundant passive protection device; or b) They are provided with redundant active protection that remains functional and energized upon loss of power/failure of the first level active protection; or c) They are determined to fail safe upon loss of power to/failure of the active circuit.		N/A

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16.5	<p>Devices relied upon for critical safety as noted in 16.4(a) – (b) shall minimally comply with the applicable Environmental Stress tests described in Sections 9 – 22 of the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, or fully comply with appropriate functional safety requirements below. Devices solely relied upon for critical safety as noted in 16.4 (c) shall fully comply with appropriate functional safety requirements in one of the following standards as appropriate to the design of the electronic and software protection scheme:</p> <p>a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, or the Standard for Safety Functions Incorporating Electronic Technology, CSA-C22.2 No. 0.8, and the Standard for Software in Programmable Components, UL 1998;</p> <p>b) The Standard for Automatic Electrical Controls for Household and Similar Use – Part 1: General Requirements, UL 60730-1 or CAN/CSA-E60730-1; and</p> <p>c) The Standard for Functional Safety of Electrical/Electronic/Programmable Electronic Safety- Related Systems – Part 1: General Requirements, IEC 61508-1, and all parts.</p>		N/A
16.6	<p>A personal e-mobility device containing hazardous voltage shall have a manual disconnect to prevent inadvertent access to hazardous voltage parts during servicing. The manual disconnect shall:</p> <p>a) Disconnect both poles of the hazardous voltage circuit;</p> <p>b) Require manual action to break the electrical connection;</p> <p>c) Ensure disconnection is physically verifiable and can include actual removal of the battery system from the personal e-mobility device or unplugging the battery system connector/plug; and</p> <p>d) When engaged (i.e. under disconnection), it does not create exposed conductors capable of becoming energized and is insulated to prevent a shock hazard during actuation.</p>		N/A
16.7	<p>If a hazardous voltage automatic disconnect device is provided to isolate accessible conductive parts from the hazardous voltage circuit of the battery system, it shall:</p> <p>a) Not be able to be reset automatically although it may be able to be reset deliberately upon clearing of the fault;</p> <p>b) Disconnect both poles of the hazardous voltage circuit;</p> <p>c) Be capable of handling full load disconnects of the hazardous voltage circuit that it is isolating; and</p> <p>d) Not result in a hazardous condition upon automatic actuation.</p>		N/A

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16.8	The personal e-mobility device shall have charger connect-interlock so that the unit cannot be activated when the charger is plugged in.		N/A
17	Cells and Batteries		N/A
17.1	Cells shall be designed to safely withstand anticipated abuse conditions for personal e-mobility devices. Compliance is determined by the requirements in 17.2- 17.10 and by the tests of this Standard.		N/A
17.2	Lithium ion and other lithium based cells shall comply with the requirements for secondary lithium cells in UL/ULC 2580.		N/A
17.3	The temperature limits need to consider the cell manufacturer's specified temperatures limits on the cell casing surface during charging and discharging. When evaluating the cell and battery control combination, consideration must be given to tolerances in the control circuitry for charging. If the control circuitry settings with tolerances exceed the cell charge specifications for voltage, testing of the cell needs to be repeated with the cell charged to these higher voltage values.		N/A
17.4	Nickel metal hydride cels and other nickel based cells shall comply with the nickel cell requirements in UL/ULC 2580.		N/A
17.5	Valve regulated lead acid batteries shall comply with the pressure release test of the Standard for Standby Batteries, UL 1989.	Certificate Number: UL-US-L61820-033411- 51216102-1	N/A
17.6	Electrochemical capacitors shall comply with the capacitor requirements in the Standard for Electrochemical Capacitors, UL 810A.		N/A
17.7	Sodium nickel metal chloride cells shall comply with the requirements for sodium beta battery cells outlined in the Test Program for Sodium-Beta Battery Cells Annex in UL 1973.		N/A
17.8	Sodium Ion cells shall comply with the requirements of the Cell Test Program Annex in UL 1973		N/A
17.9	Rechargeable batteries that provide power to the drivetrain unit of personal e-mobility devices may comply with the requirements of this Standard or UL/ULC 2271. Batteries complying with UL/ULC 2271 may need not to be evaluated with the requirements of: a)The Overcharge Test, Section 24, b)Short Circuit Test, Section 25 c)Overdischarge Test, Section 26; and d)Imbalanced Charging Test, Section 29		N/A

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
17.10	Rechargeable batteries that provide power to other than the drivetrain unit shall comply with UL 2054 or UL 62133-2/CSA C22.2 No.62133-2 or UL 62133-1/CSA C22.2 No.62133-1.		N/A
18	Motors		P
18.1	A traction motor used in a personal e-mobility device shall not be hazardous under locked rotor and overload conditions. Compliance is determined by the tests of this standard unless previously evaluated as part of a motor and motor protector combination evaluation.		P
18.2	Motors shall be capable of carrying the maximum normal anticipated load without exceeding temperatures on insulation and windings as determined during the temperature test.		P
18.3	Motors located in hazardous voltage circuits shall comply with the requirements of the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 or the Standard for Motors and Generators, CSA-C22.2 No. 100. Motors located in low voltage circuits shall comply with either UL 1004-1 or CSA-C22.2 No. 100 or the requirements of this standard.		N/A
19	Manufacturing and Production Line Testing		N/A
19.1	Personal e-mobility devices shall be subjected to 100% production screening as described in 19.2 and 19.6 to determine the acceptability of spacing, insulation and grounding system in production.		N/A
19.2	A dielectric withstand test shall be conducted on 100% production of personal e-mobility devices with working voltage exceeding 60 Vdc or 30 Vrms/42.4 Vpeak ac. There shall be no evidence of breakdown as a result of the dielectric voltage withstand test.	No hazardous voltage	N/A
19.3	Personal e-mobility devices with hazardous voltage circuits electrically isolated from ac mains supplied circuits shall be subjected to a production dielectric withstand voltage consisting of an dc or ac potential of twice the rated voltage. For those personal e-mobility devices with hazardous voltage circuits intended for connection to an ac mains supply or not electrically isolated from ac mains circuits, the test voltage shall be an essentially ac potential of frequency 60 Hz at 1,000 V plus twice the rated voltage. If using a dc potential to test the non-isolated circuit, the test voltage shall be 1.414 times the ac test potential value of 1,000V plus twice the rated voltage.		N/A
19.4	The test voltages shall be applied for a minimum of 1 minute with the cells/modules disconnected in a manner to prevent inadvertent charging during application of the voltage.		N/A

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>Exception No. 1: The time for the production Dielectric Withstand Test can be reduced to 1 s. If the value of the voltage noted above is increased as follows:</p> <p>a) 2.4 times the circuit voltage for those circuits isolated from the ac mains supply; and</p> <p>b) 1200 plus 2.4 times the circuit voltage for those circuits not isolated from the ac mains supply.</p> <p>Exception No. 2: Semiconductors or similar electronic components not relied upon to protect from electric shock and liable to be damaged by application of the test voltage may be bypassed or disconnected.</p> <p>Exception No. 3: The test is able to be performed on a partial or modified unit as long as it has been evaluated to be representative of a complete device.</p> <p>Exception No. 4: The Isolation Resistance Test of Section 30 can be conducted in lieu of the dielectric withstand test.</p>		N/A
19.5	The test equipment shall consist of a 500VA or larger capacity transformer, the output voltage, which is variable and which is essentially sinusoidal if using an ac test method and dc output if using a dc test method. There is no trip current setting for the test equipment since the test is checking for insulation breakdown, which results in a large increase of current.		N/A
	Exception: A 500VA or larger capacity transformer need not be used if the transformer is provided with a voltmeter that directly measures the applied output potential.		N/A
19.6	A continuity check of the grounding conductors using a mega ohmmeter or other method shall be conducted on 100% production employing protective grounding. The continuity check shall determine that the resistance of the protective grounding system does not exceed 0.1Ω.		N/A
19.7	The manufacturer is required to have documented production process controls in place that continually monitor the following key elements of the manufacturing process that can affect safety: (a) supply chain control and (b) assembly processes, and it shall include corrective/preventative action to address defects found affecting the key elements.		N/A

PERFORMANCE			
20	General		P
20.1	Unless indicated otherwise, personal e-mobility device batteries shall be fully charged in accordance with the manufacturer's specifications for conducting the tests in this standard. After charging and prior to testing, the batteries shall be allowed to rest for a maximum period of 8h at room ambient.		P

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
20.2	Unless otherwise indicated, fresh samples representative of production are to be used for the tests described in this standard. The test program and number of samples to be used in each test is shown in Table 20.1.		P
20.3	All tests, unless noted otherwise, are conducted in a room ambient $25 \pm 5^{\circ}\text{C}$ ($77 \pm 9^{\circ}\text{F}$).		P
20.4	Temperature shall be measured using thermocouples consisting of wires not larger than 0.21 mm^2 (24 AWG) and not smaller than 0.05 mm^2 (30 AWG) connected to a potentiometer-type instrument. Temperature measurements are to be made with the measuring junction of the thermocouple held tightly against the component/location being measured. For those tests that require the sample to reach thermal equilibrium (also referred to as steady state conditions), thermal equilibrium is considered to be achieved if after three consecutive temperature measurements taken at intervals of 10% of the previously elapsed duration of the test but not less than 15 min, indicate no change in temperature greater than $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$).		P
20.5	Where there is a specific reference to a single fault condition in the individual test methods, the single fault is to consist of a single failure (i.e. open, short or other failure means) of any component in the personal e-mobility devices that could occur and affect the results of the test. Faulting over two redundant components that have not been determined to be independent of each other is considered a single fault condition. This fault is implemented in conjunction with the test being conducted (i.e. overcharge, short circuit, etc.) or may be conducted as part of a verification of a protective circuit. A protective device determined to be reliable may remain in the circuit without being faulted. See Appendix A and 2.1. A protective device determined to be reliable is one that has been shown to comply with an appropriate component safety standard and is used within its ratings.		P

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
20.6	The tests contained in this standard may result in explosions, fire and emissions of flammable and/or toxic fumes as well as electric shock. It is important that personnel use extreme caution and follow local and regional worker safety regulations when conducting any of these tests and that they be protected from flying fragments, explosive force, and sudden release of heat and noise that could result from testing. The test area is to be well ventilated to protect personnel from possible harmful fumes or gases. As an additional precaution, the temperatures on surface of at least one cell/module within the DUT are to be monitored during the test for safety and information purposes. All personnel involved in the testing are to be instructed to never approach the DUT until temperatures are falling and have returned to within ambient temperatures		P
20.7	Unless noted otherwise in the individual test methods, the tests shall be followed by a minimum 1h observation time prior to concluding the test and temperatures are to be monitored in accordance with 20.6.		P
20.8	Some testing may be waived for battery systems previously evaluated to UL/ULC 2271, if determined equivalent to the testing of this Standard in the personal e-mobility device system. These tests would include the following: Overcharge, Short Circuit, Overdischarge, and Imbalanced Charging However, it must be determined through analysis that the tests conducted on the battery pack in accordance with UL/ULC 2271 are representative of testing with the system in accordance with this Standard.		N/A
21	Tolerances		P
21.1	Unless noted otherwise in the test methods, the overall accuracy of measured values of test specifications or results when conducting testing in accordance with this standard, shall be within the following values of the measurement range. a) $\pm 1\%$ for voltage; b) $\pm 1\%$ for current; c) $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$) for temperature at or below 200°C (392°F) and $\pm 3\%$ for temperatures above 200°C (392°F); d) $\pm 0.1\%$ for time; and e) $\pm 1\%$ for dimension.		P
22	Post Test Cycle		P

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
22.1	Personal e-mobility devices that are operational after the following tests shall be subjected to a minimum of one cycle of charging and discharging or if not operational, subjected to an attempt to charge only in accordance with the manufacturer's specifications for at least 1 h to determine that there is no non-compliant results as outlined in Table 22.1 for that test:		P
	a) Electrical Tests – Overcharge, short circuit, overdischarge protection, imbalanced charging; b) Mechanical Tests – Vibration, shock, drop, crush; and c) Environmental Tests – Water exposure, and thermal cycling.		P
22.2	The method of discharging the batteries may vary according to the personal e-mobility device design and should be a method agreed upon by the manufacturer and organization testing the personal e-mobility device.		P
23	Results Criteria		P
23.1	See Table 22.1 for results criteria for tests outlined in this standard and Glossary, Section 6 for definitions of the non-compliance results terms. See also individual tests methods for any additional details.		P

	ELECTRICAL TESTS		P
24	Overcharge Test	Recognized battery pack	N/A
25	Short Circuit Test		P
26	Overdischarge Test	Recognized battery pack	N/A
27	Temperature Test		P
28	Post-Discharge Charging Determination Test	Recognized battery pack	N/A
29	Imbalanced Charging Test		N/A
30	Dielectric Voltage Withstand Test		N/A
31	Isolation Resistance Test		N/A
32	Leakage Current Test		N/A
33	Grounding Continuity Test		
	MECHANICAL TESTS		P
34	Vibration Test		P
35	Shock Test .		P
36	Input Test		
37	Crush Test		P
38	Drop Test		N/A
39	Mold Stress Relief Test		P
40	Handle Loading Test		P

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
41	Motor Overload Test		P
42	Motor Locked Rotor		P
43	Strain Relief Tests (Cord Anchorages)		N/A
43.2	Strain relief pull test		N/A
43.3	Push-back test		N/A
	ENVIRONMENTAL TESTS		P
44	Water Exposure Tests .		N/A
44.1	IPX4 Code rating		N/A
44.2	Partial immersion		N/A
45	Thermal Cycling Test .		P
46	Label Permanence Test		N/A

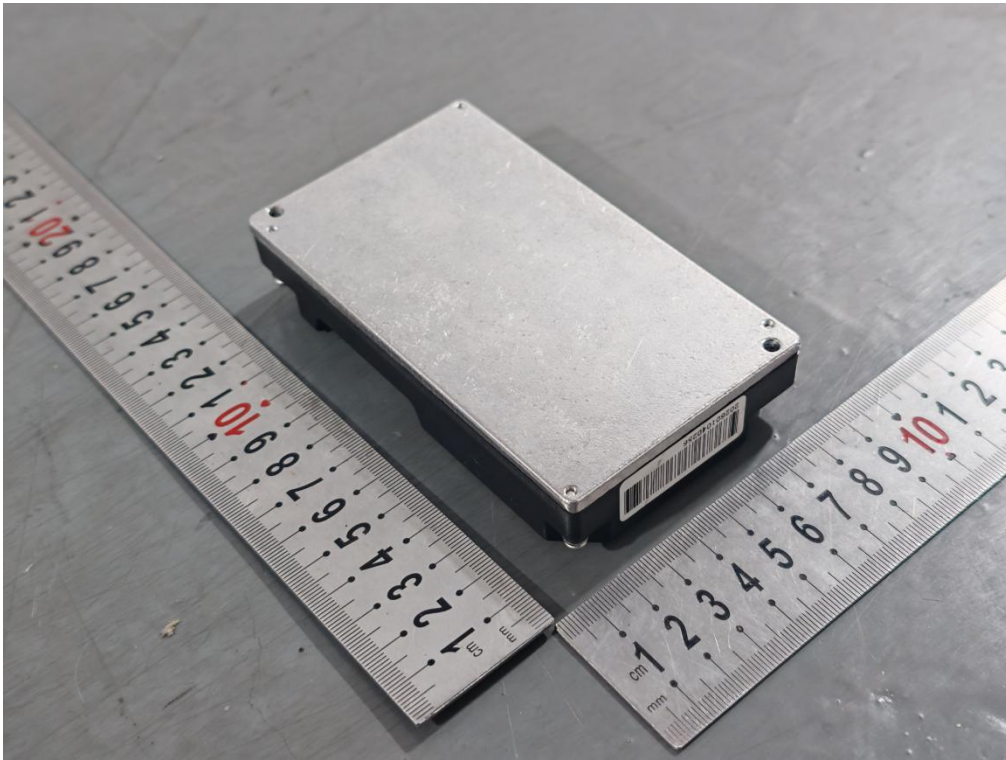
	MARKINGS		N/A
	Advisory Note: In Canada, there are two official languages, English and French. Appendix B provides translations in French of the English safety markings specified in this standard. Markings required by this standard may have to be provided in other languages to conform with the language requirements of the country where the product is to be used.		N/A
47	General		
47.1	The markings required for compliance shall be legible and permanent such as etched, adhesive labels, etc. An adhesive-backed label shall comply with the requirements in the Standard for Marking and Labeling Systems, UL 969, or the Standard for Adhesive Labels, CSA-C22.2 No. 0.15, for the intended exposure conditions and surface adhered to. Exception: Adhesive labels may be alternately evaluated to the Label Permanence Test in Section 46.		N/A
47.2	Personal e-mobility devices are to be marked with the manufacturer's name, trade name, trademark or other descriptive marking which may identify the organization responsible for the product, part number or model number, and electrical ratings in volts dc and Ah or Wh. The personal e-mobility device is to also be marked with the maximum weight in lbs or kg and speed in mph or km/h.		N/A
47.3	Personal e-mobility devices shall also be marked with the date of manufacture, which may be in the form of a code that does not repeat within 10 years.		N/A
47.4	Personal e-mobility devices shall be marked with charging instructions. An example of such markings would be the following or equivalent "Use Only () Charger".		N/A

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
47.5	All external terminals and connections shall be provided with identification and if applicable, polarity markings.		N/A
47.6	Personal e-mobility devices with separable battery packs that are intended to be user removable are to include markings indicating the correct battery pack to use with the personal e-mobility device, such as "Use only () battery pack with this personal e-mobility device". The separable battery pack shall be marked "Use only with () personal e-mobility device". The information to be filled in shall minimally be the manufacturer's name and the model number of the part for correlation.		N/A
47.7	The point of connection to the charger earth grounding system shall be identified by the word "Ground" or the letters "G" or "GR" (except in Canada) or the grounding symbol IEC 60427, No. 5019 (upside down tree within a circle) or otherwise identified by a distinctive green color. Any other grounding terminals shall also be identified in a manner that is distinctive from the main earth ground terminal for the charger system.		N/A
47.8	Personal e-mobility devices that contain hazardous voltage circuits shall be marked "Warning: Hazardous Voltage Circuits" or be marked with the electric shock hazard symbol ISO 3864, No. 5036 (lightning bolt within a triangle)		N/A
47.9	Personal e-mobility devices shall be marked as follows: "WARNING – To reduce the risk of injury, user must read instruction manual" or shall be marked with the sign M002 of the Standard for Graphical Symbols Safety Colours and Safety Signs, Safety Signs Used in Workplaces and Public Area, ISO 7010, and ISO 7010, No. W001 (i.e. exclamation point in triangle).		N/A
47.10	A personal e-mobility device may or may not be marked with the minimum required IPX4 rating. Personal e-mobility devices marked with a higher IP rating than the minimally required rating of IPX4, shall comply with the requirements for that higher rating in accordance with 44.1.		N/A
47.11	Personal e-mobility devices employing plastic enclosure materials not evaluated for exposure to UV rays and rain per 7.5 shall be marked with the following or equivalent: "Store indoors When Not in Use". See also 48.5.		N/A
47.12	The following or equivalent marking shall be provided on the battery enclosure and/or device enclosure that serves as the outer enclosure of the battery: "WARNING - Risk of Fire and Electric Shock -Battery and/or battery components are not user replaceable."		P

ANSI/CAN/UL-2272:2024			
Clause	Requirement + Test	Result - Remark	Verdict
	INSTRUCTIONS		P
48	General		P
48.1	A personal e-mobility device shall be provided with instructions for the proper use including charging and operating, storage and disposal. These instructions shall include temperature limits, appropriate charger and weight limits (maximum and minimum). The personal e-mobility device instructions shall also include the maximum speed obtainable by the personal e-mobility device. The instructions shall also provide information on water and other environmental exposures as well as recommendations on surfaces for travel, use on gradients, etc. as applicable to the personal e-mobility device design. Instructions for replacement of user replaceable fuses and light bulbs shall also be provided.		P
48.2	user removable battery pack intended for removal and charging outside of the personal e-mobility device shall be provided with instructions for the safe handling including removal and insertion into the personal e-mobility device and during charging and instructions for storage outside of the personal e-mobility device.		P
48.3	The following or equivalent marking shall be provided in the instructions: "WARNING – Risk of Fire and Electric Shock – No User Serviceable Parts". Contact information for servicing the personal e-mobility device shall be provided. Exception No. 1: If the personal e-mobility device does not contain circuits above 60 Vdc or 30 Vrms/4.24 Vpeak, the instructions shall be replaced by the following or equivalent: "WARNING – Risk of Fire – No User Serviceable Parts". Exception No. 2: Accessible fuse or bulb replacement or equivalent is allowed to be user replaced.		P
48.4	The following or equivalent marking shall be provided in the instructions: "WARNING: Risk of Fire and Electric Shock- Battery and/or battery components are not user replaceable.		
48.5	Personal e-mobility devices not intended for use in high altitude locations, which may require increased electrical spacings in electrical circuits, shall indicate that they are not intended for use at elevations greater than 2000m above sea level. See 14.2.		P
48.6	Personal e-mobility devices intended to be stored indoors to protect against prolonged exposure to UV rays or the elements that may damage enclosure materials per 7.5, shall have the following or equivalent included in the instruction manual: "Prolonged Exposure to UV Rays, Rain and the Elements May Damage the Enclosure Materials, Store Indoors When Not in Use".		P

Photos**Fig. 1****Fig. 2**

Photos**Fig. 3****Fig. 4**

Photos**Fig. 5****Fig. 6**

Photos**Fig. 7****Fig. 8**

Photos**Fig. 9****Fig. 10**

**Fig. 11****Fig. 12**

--- End of Report ---