TEST REPORT
UL 2272
STANDARD FOR SAFETY Electrical Systems for Personal E-Mobility Devices

Report Reference No.....:	BOKE-240813308S
Date of issue.....:	Jul. 23, 2024
Total number of pages……..:	32
Testing Laboratory.....:	**Shenzhen Boke Testing Co., Ltd.**
Address.....:	Floor 2, Complex Building, No. 438 Industrial Park, Donghuan Road, Xiner Community, Xinqiao Street, Bao'an District, Shenzhen, GuangDong, China
Applicant's name.....:	**Yongkang Anluosen Sports Equipment Co., Ltd.**
Address.....:	No. 98, Shifang West Road, Shiya Xia Street, Shiya Xia Natural Village, Gushan Town, Yongkang City, Jinhua, Zhejiang Province, China
Test specification:	
Standard.....:	UL Standard for Safety for Electrical Systems for Personal E-Mobility Devices, UL 2272 First Edition, Dated November 21, 2016+FEBRUARY 25, 2019
Non-standard test method……..:	N/A
Test Report Form No.....**:**	UL 2272
Test Report Form(s) originator.....:	Boke
Master TRF.....:	Dated 2020-08
Test item description.....**:**	electric scooter
Trade Mark.....:	N/A
Manufacturer.....:	**Yongkang Anluosen Sports Equipment Co., Ltd.** No. 98, Shifang West Road, Shiya Xia Street, Shiya Xia Natural Village, Gushan Town, Yongkang City, Jinhua, Zhejiang Province, China
Model/Type reference.....:	D20
Ratings.....:	54.6V, 2A External power supply:Input:100-240VAC,50/60Hz, 1.6A Output :54.6V, 2A

General disclaimer:

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

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Name and address of the testing laboratory:

Shenzhen Boke Testing Co., Ltd.
Floor 2, Complex Building, No. 438 Industrial Park,
Donghuan Road, Xiner Community, Xinqiao Street,
Bao'an District, Shenzhen, GuangDong, China

Date of Test.....: Jul. 17, 2024 – Jul. 22, 2024

Tested by (name + signature)..... : Bill Liu

Reviewed by (name + signature).....: Jeff Fu

Approved by (name + signature).....: Peter Huang

Report revise record:

No.	Issue Date	Report Number	Revisions	Effect Page	Note
1	Jul. 22, 2024	BOKE-240813308S	Original report	N/A	--

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

Attachment 1: 3 pages of product photos.

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
The sample(s) tested complies with the requirements of UL 2272 First Edition, Dated November 21, 2016+FEBRUARY 25, 2019	Shenzhen Boke Testing Co., Ltd. Floor 2, Complex Building, No. 438 Industrial Park, Donghuan Road, Xiner Community, Xinqiao Street, Bao'an District, Shenzhen, GuangDong, China

General product information

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Copy of marking plate:

electric scooter

D20
54.6V, 2A
External power supply:Input:100-240VAC,50/60Hz, 1.6A
Output :54.6V, 2A

Manufacturer:Yongkang Anluosen Sports Equipment Co., Ltd.
No. 98, Shifang West Road, Shiya Xia Street, Shiya Xia Natural Village, Gushan Town, Yongkang City, Jinhua, Zhejiang Province, China
Made in China
Manuf. Date:2024,05

Test item particulars.....:	
Supply Connection.....:	External power supply
.....:	
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item.....:	Jul. 17, 2024
Date (s) of performance of tests.....:	Jul. 17, 2024 – Jul. 22, 2024

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

When differences exist; they shall be identified in the General product information section.

STANDARD FOR SAFETY Electrical Systems for Personal E-Mobility Devices, UL 2272 Issued: 2016/11/21 Ed. 1 Rev: 2019/02/25		
Clause	**Description Requirement**	**Verdict**
24	Overcharge Test	P
25	Short Circuit Test	P
26	Overdischarge Test	P
27	Temperature Test	P
28	Imbalanced Charging Test	P
29	Dielectric Voltage Withstand Test	P
30	Isolation Resistance Test	P
31	Leakage Current Test	P
32	Grounding Continuity Test	N/A
33	Vibration Test	P
34	Shock Test	P
35	Crush Test	P
36	Drop Test	P
37	Mold Stress Relief Test	N/A
38	Handle Loading Test	P
39	Motor Overload Test	P
40	Motor Locked Rotor	P
41	Strain Relief Tests (Cord Anchorages)	N/A
41.2	Strain relief pull test	N/A
41.3	Push-back test	N/A
42	Water Exposure Tests	N/A
43	Thermal Cycling Test	P
44	Label Permanence Test	P

UL 2272			
Clause	Requirement + Test	Result - Remark	Verdict
INTRODUCTION			
1	Scope		P
1.1	These requirements cover the electrical drive train system including the battery system, other circuitry and electrical components for electric powered scooters and other devices to be referred to as personal e-mobility devices as defined in this standard.		P
1.2	This standard is intended for evaluation of the safety of the electrical drive train system and battery and charger combination for energy and electrical shock hazards and does not evaluate the performance or reliability of these devices. In addition, it does not evaluate the physical hazards that may be associated with the use of personal e-mobility devices.		P
ELECTRICAL TESTS			
24	Overcharge Test		P
24.1	This test is intended to evaluate a DUT's ability to withstand an overcharge condition under non-faulted and under a single fault in the charging control circuitry that could result in an overcharge condition.		P
24.2	A fully charged sample is to be discharged at a 0.2 C constant discharge rate or a higher discharge rate permitted by the cell manufacturer to the manufacturer's specified EODV. The DUT is then subjected to a constant current charging at the cell manufacturer's maximum specified charging rate and under a single fault condition in the charging protection circuitry that could lead to an overcharge condition. Protective devices that have been determined reliable may remain in the circuit as noted in 20.5. For information purposes, temperatures are to be monitored on the cell/module where temperatures may be highest. The output control circuitry of external chargers with standardized output connectors (e.g. USB connectors) that may result in the use of unspecified chargers shall not be considered as a reliable control to prevent an overcharging condition.		P
24.3	The test is to be continued until the voltage has reached 110% of the specified upper		P

	limit charging voltage or the maximum obtainable charging voltage (if the 110% of specified upper limit charging voltage cannot be reached due to remaining protection circuitry), and monitored temperatures return to ambient or steady state conditions and an additional 2 h has elapsed, or explosion/fire occur. If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the cell manufacturer's maximum specified values per Section 22, Post Test Cycle. The test shall be followed by an observation period per 20.7.		
24.4	At the conclusion of the observation period, the samples with hazardous voltage circuits shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30, (without humidity conditioning).		P
24.5	If a protective device in the circuit operates, the test is repeated at 90% of the trip point of the protection device or at some percentage of the trip point that allows charging for at least 10 min.Temperatures shall be measured on the DUT for monitoring purposes		P
25	Short Circuit Test		P
25.1	This test evaluates a DUT's ability to withstand a short circuit condition.		P
25.2	A fully charged sample of the battery system is to be short-circuited by connecting the positive and negative terminals of the sample with a circuit load having a total resistance of less than or equal to 20mΩ.		P
25.3	Samples are to be subjected to a single fault across any protective device in the load circuit.Protective devices that have been determined reliable may remain in the circuit as noted in 20.5.		P
25.4	The sample shall be discharged until the sample has returned to ambient temperature or fire or explosion occurs. Temperatures shall be measured on the DUT for monitoring purposes.		P
25.5	If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle. The test shall be followed by an observation period per 20.7.		P
26	Overdischarge Test		P
26.1	This test is intended to evaluate a DUT's ability to withstand an overdischarge under		P

	protection circuitry fault condition.		
26.2	The fully charged sample is to be subjected to a constant discharging current at the maximum discharging current specified by the manufacturer under a single fault condition in the discharging circuit of the DUT that could lead to an overdischarge condition. Protective devices that have been determined reliable may remain in the circuit as noted in 20.5. Temperatures shall be measured on a cell/module for monitoring purposes.		P
26.3	The test is to be continued until the sample is fully discharged to a near zero state or protective devices remaining in the circuit operate, and the monitored temperatures return to ambient or steady state, or explosion and/or fire occurs. If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle. The test shall be followed by an observation period per 20.7.		P
26.4	At the conclusion of the observation period, the samples with hazardous voltage circuits shall be subjected to an Isolation Resistance Test, Section 30, (without humidity conditioning) or a Dielectric Voltage Withstand Test, Section 29.		P
26.5	As a result of the overdischarge test, any of the following results in (a) – (e) below are considered a non-compliant result. See also Table 22.1 and Section 23, Results Criteria. a) E – Explosion; b) F – Fire; c) R – Rupture (enclosure); d) L – Electrolyte Leakage (external to enclosure); and e) S – Electric shock hazard (resistance below isolation resistance limits or dielectric breakdown). Voltages on the cells are not to exceed the specified end of discharge voltage limits.		P
27	Temperature Test		P
27.1	This test is conducted to determine whether or not the component cells are being maintained within their specified operating limits during maximum charge and discharge conditions of the personal e-mobility device. During this test, it shall also be determined as to whether or not temperature sensitive safety critical components and temperature sensitive		P

	materials in the personal e-mobility device are being maintained within their temperature ratings based upon the maximum operating temperature limits of the personal e-mobility device. Temperatures on accessible surfaces, which may be contacted by the user, are also monitored.		
27.2	The manufacturer's specified limits (voltage, current and temperatures measured) shall not be exceeded during the charging and discharging cycles. Temperatures measured on components shall not exceed their specifications. See Tables 27.1 and 27.2 for surface and component temperature limits.		P
27.3	As a result of the temperature test, any of the following results in (a) – (e) below are also considered a non-compliant result. See also Table 22.1 and Section 23, Results Criteria. a) E – Explosion; b) F – Fire; c) R – Rupture (enclosure); d) L – Electrolyte Leakage (external to enclosure); and e) S – Electric shock hazard (resistance below isolation resistance limits or dielectric breakdown).		P
28	Imbalanced Charging Test		P
28.1	This test is to determine whether or not a DUT with series connected cells can maintain the cells within their specified operating parameters if it becomes imbalanced.		P
28.2	A fully charged DUT shall have all of its cells with the exception of one cell/cell block discharged to its specified fully discharged condition. The undischarged cells shall be discharged to approximately 50% of its specified state of charge (SOC) to create an imbalanced condition prior to charging		P
28.3	The DUT shall then be charged in accordance with the manufacturer's specifications using the specified charger and under a single fault condition in the charging protection circuitry. Protective devices that have been determined reliable may remain in the circuit as noted in 20.5. The voltage of the partially charged cells shall be monitored during the charging to determine if its voltage limits are exceeded. If the DUT is operational after the test, it shall be subjected to a minimum		P

	of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle.		
28.4	At the conclusion of the observation period, the samples with hazardous voltage circuits shall be subjected to an Isolation Resistance Test, Section 30, (without humidity conditioning) or a Dielectric Voltage Withstand Test, Section 29.		P
28.5	The maximum voltage limit of the cells shall not exceed the manufacturer's specifications. In addition, any of the following results in (a) – (e) below are considered a non-compliant result. See also Table 22.1 and Section 23, Results Criteria. a) E – Explosion; b) F – Fire; c) R – Rupture (enclosure); d) L – Electrolyte Leakage (external to enclosure); and e) S – Electric shock hazard (resistance below isolation resistance limits or dielectric breakdown).		P
29	Dielectric Voltage Withstand Test		P
29.1	This test is an evaluation of the electrical spacings and insulation at hazardous voltage circuits within the DUT.		P
29.2	Circuits at 60 Vdc or 30 Vrms or higher and electrically isolated from ac mains supplied circuits shall be subjected to a dielectric withstand voltage consisting of a dc potential of twice the rated voltage.		P
30	Isolation Resistance Test		P
30.1	This test is intended to determine that insulation of the DUT provides adequate isolation of hazardous voltage circuits from accessible conductive parts of the DUT and that the insulation is non-hygroscopic.		P
30.2	A DUT with accessible parts shall be subjected to an insulation resistance test between the positive terminal and accessible dead metal parts of a DUT. If the accessible parts of the DUT are covered with insulating material that may become live in the event of an insulation fault, then the test voltages are applied between each of the live parts and metal foil in contact with the accessible parts as shown in 29.6 and Figure 29.1.		P
30.3	The insulation resistance shall be measured after a 60-s application with a high resistance voltmeter using a 500 Vdc potential applied for at least 1 min to the locations under test.		P
30.4	The test shall be repeated on a sample subjected to humidity conditioning in		P

	accordance with the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, or the Standard for Information Technology Equipment – Safety – Part 1: General Requirements,CAN/CSA-C22.2 No. 60950-1, Clause 2.9.2. Measurements shall be made with the sample still in the chamber.		
30.5	The measured insulation resistance between the positive terminals and accessible parts of the DUT shall be at least 50,000 Ω.		P
31	Leakage Current Test		P
31.1	This test is intended to evaluate a personal e-mobility device containing hazardous AC voltage circuits that can connect to mains AC during charging, for hazardous levels of leakage current.		P
31.2	The leakage current of a DUT when tested in accordance with 31.3 to 31.5 shall not be more than 0.5 milliampere.		P
31.3	All exposed conductive surfaces shall be tested for leakage currents. The leakage currents from these surfaces are to be measured to the grounded supply conductor individually as well as collectively if simultaneously accessible, and from one surface to another if simultaneously accessible. Surfaces are considered to be simultaneously accessible if they can be readily contacted by one or both hands of a person at the same time. If all accessible surfaces are bonded together and connected to the grounding conductor of the power supply cord, the leakage current may be measured between the grounding conductor and the grounded supply conductor.		P
31.4	If a conductive surface other than metal is used for the enclosure or a part of the enclosure, the leakage current is to be measured using a metal foil with an area of 10 by 20 centimeters (3.9 by 7.9 inches) in contact with the surface as shown in Figure 29.1. If the surface is less than 10 by 20 centimeters, the metal foil is to be the same size as the surface.		P
32	Grounding Continuity Test		N/A
32.1	Personal e-mobility devices with grounding and bonding systems shall be tested to determine that the resistance of that grounding/bonding circuit does not exceed the 0.1 Ohm limit per 15.4.		N/A
32.2	The resistance of the grounding/bonding circuit can be measured between two points on the bonding connections of the		N/A

	grounding circuit using a milli-ohmmeter.		
32.3	The measured resistance between any two bonding connections shall be less than or equal to 0.1 Ohm.		N/A
MECHANICAL TESTS			
33	Vibration Test		P
33.1	This test evaluates the DUT's ability to withstand vibration that may occur during its anticipated use.The test shall be performed in accordance with the Standard for Electrically Propelled Road Vehicles – Test Specification for Lithium-Ion Traction Battery Packs and Systems – Part 1: High-Power Applications,ISO 12405-1, without temperature conditioning, (which references the Standard for Environmental Testing – Part 2-64: Tests – Test Fh: Vibration, Broadband Random and Guidance, IEC 60068-2-64) per Table 6 of the Standard for Batteries for Use in Light Electric Vehicle (LEV) Applications, UL 2271, or CAN/ULC-S2271, or to a test profile determined by the customer and verified to the personal e-mobility device application.		P
33.2	The DUT is to be securely mounted to a vibration test platform in a manner similar to how it is oriented during use located within a chamber or test room, where the temperature during testing can be varied. The DUT is to be subjected to a random vibration along three perpendicular axes in space in a sequence starting with the vertical axes (Z) and ending with the longitudinal axis (X).		P
33.3	The DUT shall be subjected to the vibration in each axis for 21 h if testing one sample, 15 h if testing two samples or 12 h if testing 3 samples. For each axis the frequency shall be varied from 5 Hz to 200 Hz with power spectral density (PSD) for the vertical (Z) axis, the longitudinal (X) axis, and the transverse (Y) axis as outlined in the Standard for Electrically Propelled Road Vehicles – Test Specification for Lithium-Ion Traction Battery Packs and Systems – Part 1: High-Power Applications, ISO 12405-1.		P
33.4	If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle. The test shall be followed by an observation period per 20.7.		P
33.5	At the conclusion of the observation period, the samples with hazardous voltage circuits shall be subjected to a Dielectric Voltage		P

	Withstand Test, Section 29, or Isolation Resistance Test, Section 30,(without humidity conditioning). The sample shall be examined with the probe of 9.1.3 to determine if it is possible to access hazardous parts if applicable.		
34	Shock Test		P
34.1	This test is intended to determine whether or not the DUT can withstand a mechanical shock that may occur when in use.		P
34.2	The fully charged sample of the personal e-mobility device is to be secured to the testing machine by means of a rigid mount, which supports all mounting surfaces of the sample. Temperatures on the center cell are monitored for information purposes.		P
34.3	The sample is to be subjected to mechanical shock testing with parameters as shown in Table 34.1 or according to a test profile determined by the customer and verified to the personal e-mobility device application. When considering the level of shock, the weight of the DUT and maximum specified weight of the rider need to be considered. The battery can be tested first separately from the personal e-mobility device and the higher shock levels for lighter devices prior to testing the complete assembly. The shocks are to be applied in all 6 spatial directions.		P
35	Crush Test		P
35.1	This test is conducted to determine the DUT's ability to withstand a crush that could occur during use.		P
35.2	This test is conducted on a fully charged DUT.		P
35.3	One sample of the personal e-mobility device is to be supported on a fixed rigid supporting surface,in the position and orientation that is representative of operation of the personal e-mobility device. A crushing force is to be applied to the personal e-mobility device foot support surface by two flat applicator plates each sized 102 by 254 mm (4 by 10 inches). A force of 2 times the maximum specified rider weight is to be evenly distributed between the two applicator plates to the personal e-mobility device foot support surface. The total weight of the force applied to the personal e-mobility device foot support surfaces is to include the weight of the flat applicators.		P
35.4	The test force is to be held in place for a		P

	minimum of one minute. The sample shall be only subjected to one crush. If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle. The test shall be followed by an observation period per 20.7.		
35.5	At the conclusion of the observation period, samples with hazardous voltage circuits shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30,(without humidity conditioning). The sample shall be examined with the probe of 9.1.3 to determine if it is possible to access hazardous parts if applicable.		P
36	Drop Test		P
36.1	This test is intended to evaluate whether a hazard exists when an DUT is subjected to an inadvertent drop during lifting or handling by the user when charging or replacement, etc.		P
36.2	A fully charged DUT is to be dropped three times from a height of 1.0 ±0.01 m (39.4 ± 0.4 in) to strike a concrete surface in a manner most representative of what would occur during lifting or handling of the DUT by the user. The concrete surface shall be at least 76-mm (3-in) thick and shall be large enough in area to cover the DUT. If the DUT is operational after the drop, it is to be subject to a minimum of one normal charge/discharge cycle in accordance with the manufacturer's specifications.		P
36.3	DUTs shall be conditioned for a minimum of 3 h at 0°C (32ºF) (or temperature specified if lower than 0°C (32ºF)) prior to conducting the drop test, which shall be conducted immediately after removing the samples from the cold conditioning.		P
36.4	If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values. The test shall be followed by an observation period per 20.7 and then examined.		P
36.5	After the examination, the DUTs shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30, (without humidity conditioning) if applicable.		P
36.6	There shall be no damage of the enclosure		P

	that would allow hazardous voltage parts to be accessed by use of the test rod 2.5 mm diameter, 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, and the probe noted in 9.1.3.		
37	Mold Stress Relief Test		N/A
37.1	This test is intended to evaluate whether any shrinkage or distortion exists on a molded or formed thermoplastic enclosure due to release of internal stresses caused by the molding or forming operation and result in the exposure of hazardous parts or reduction of electrical spacings.	Metal enclosure	N/A
37.2	The sample is to be placed in a full-draft circulating-air oven maintained at a uniform temperature of 70°C (158°F). The samples are to remain in the oven for 7 h.		N/A
37.3	To prevent hazards from overheating energized cells, samples shall be fully discharged prior to conditioning.		N/A
37.4	After careful removal from the oven, the sample shall be allowed to cool to room temperature and then examined. After the examination, the samples shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30, (without humidity conditioning).		N/A
37.5	There shall be no insulation breakdown during the Dielectric Voltage Withstand Test, Section 29, or the isolation resistance shall not be below the levels outlined in the Isolation Resistance Test, Section 30.		N/A
37.6	There shall be no damage of the DUT enclosure that would allow hazardous voltage parts to be accessed by use of the test rod 2.5 mm diameter, 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, and the probe in 9.1.3.		N/A
38	Handle Loading Test		P
38.1	This test is intended to evaluate the strength of the handle(s) on a personal e-mobility device that may be used to lift the personal e-mobility device.		P
38.2	A force is to be applied on the handle in the intended carrying direction uniformly over a 75-mm(2.95-in) length at the center of the handle. The applied force shall be gradually increased from zero to four times the weight of the DUT in 5 – 10 s and then maintained at the level for 1 min.		P

38.3	If more than one handle is provided, the test force shall be determined by the percentage of the DUTweight sustained by each handle with the DUT in the intended carrying position. If a DUT weighing less than 25 kg (55.1 lbs) is provided with more than one handle and can be carried by only one handle, each handle shall be capable of withstanding a force based on the total weight of the DUT.		P
38.4	There shall be no breakage of the handle, its securing means, or that part of the DUT to which the handle is attached.		P
39	Motor Overload Test		P
39.1	This test is intended to evaluate a motor's ability to safely withstand an overload condition, which may occur in the end use application. This test is waived if the motor and its overload protection has already been evaluated as part of a motor and motor protector combination evaluation per the Standard for Rotating Electrical Machines – Thermally Protected Motors, UL 1004-3, or the Standard for Rotating Electrical Machines – Electronically Protected Motors, UL 1004-7, as applicable to the method of thermal protection.		P
39.2	The motor is to be tested while in the personal e-mobility device and temperatures on windings are to be monitored. As an alternative, the motor can be tested outside the personal e-mobility device.		P
39.3	The motor is first operated under maximum normal load conditions. The load is then increased so that the current is increased in appropriate gradual steps with the motor supply voltage being maintained at its original value. When steady state temperature conditions are established the load is again increased. The load is thus progressively increased in appropriate steps until either the overload protection device operates or the motor winding becomes an open circuit.		P
39.4	The motor winding temperatures are determined during each steady period and the maximum temperature recorded shall not exceed the value in Table 39.1.		P
40	Motor Locked Rotor		P
40.1	This test is intended to evaluate a motor's ability to safely withstand a locked rotor condition, which may occur in the end use application. This test is waived if the motor and its locked rotor protection has already been evaluated as part of a motor		P

	and motor protector combination evaluation, per the Standard for Rotating Electrical Machines – Thermally Protected Motors, UL 1004-3, or the Standard for Rotating Electrical Machines – Electronically Protected Motors, UL 1004-7, or if relying on impedance protection per the Standard for Rotating Electrical Machines – Impedance Protected Motors, UL 1004-2, as applicable.		
40.2	The motor is operated at the voltage used in its personal e-mobility device application and with its rotor locked for 7 h or until steady conditions are established. The motor is to be tested while in the personal e-mobility device and temperatures on windings are to be monitored. As an alternative, the motor can be tested outside the personal e-mobility device.		P
40.3	If the design or size of the motor prevents the measuring of temperature windings, the test may be conducted with the motor removed from the personal e-mobility device and instead of monitoring temperatures, the DUT is to be supported on a surface covered with a single layer of tissue paper with the DUT covered with a single layer of cheesecloth.		P
40.4	If the DUT contains a hazardous voltage circuit, the DUT shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30, (without humidity conditioning).		P
40.5	There shall be no insulation breakdown during the Dielectric Voltage Withstand Test, Section 29, or the isolation resistance shall not be below the levels outlined in the Isolation Resistance Test, Section 30.		P
40.6	If monitoring temperatures on windings during the locked rotor test, the temperatures on the windings shall not exceed the values noted in Table 40.1. If not monitoring temperatures on windings during the test, there shall be no sign of ignition of the tissue or cheesecloth at the conclusion of the test.		P
41	Strain Relief Tests (Cord Anchorages)		N/A
41.1.1	The strain relief tests are conducted on those personal e-mobility devices that have exposed non-detachable cords or cables that may be subjected to pull in the end use personal e-mobility device.		N/A
41.2	Strain relief pull test		N/A
41.2.1	The purpose of this test is to determine if the strain relief means for a non-detachable		N/A

	accessible cord prevents damage or displacement upon being pulled.		
41.2.2	One sample of the personal e-mobility device or accessory provided with a strain relief shall withstand without damage to the cord or conductors and without displacement, a direct pull of 2 times the weight of the DUT but no greater than 156 N (35 lbf), applied to the cord for 1 min. Supply connections within the equipment are to be disconnected from terminals or splices during the test when applicable.		N/A
41.2.3	If the cord anchorage is mounted in polymeric enclosure material, the test is to be conducted after the mold stress test and after the sample has cooled to room temperature.		N/A
41.2.4	As a result of the pull force, there was no damage or displacement of internal connectors. Inner conductors may not elongate more than 2 mm (0.08 in) from the pre-test position.		N/A
41.3	Push-back test		N/A
41.3.1	The purpose of this test is to determine if the strain relief of a non-detachable accessible cord provides adequate protection to connections and prevents hazardous displacement of internal wiring and connections as a result of push back.		N/A
41.3.2	The DUT is to be tested in accordance with 41.3.3 and 41.3.4 without occurrence of any of the following conditions: a) Subjecting the supply cord to mechanical damage; b) Exposing the supply cord to a temperature higher than that for which it is rated; c) Reducing spacings (such as to a metal strain-relief clamp) below the minimum required values; or d) Damaging internal connections or components.		N/A
41.3.3	The non-detachable cord is to be held 25.4 mm (1 in) from the point where it emerges from the DUT and is then to be pushed back into the DUT. When a removable bushing, which extends further than 25.4 mm (1 in) is present it is to be removed prior to the test.		N/A
41.3.4	When the bushing is an integral part of the cord, then the test is to be carried out by holding the bushing. The cord is to be pushed back into the product in 25.4-mm		N/A

	(1-in) increments until the cord buckles or the force to push the cord into the product exceeds 26.7 N (6 lbf).		
ENVIRONMENTAL TESTS			
42	Water Exposure Tests		N/A
42.1	IPX4 Code rating		N/A
42.1.1	This test is intended to evaluate the personal e-mobility device's ability to withstand potential water exposure in its intended use and is conducted in accordance with the test method outlined in 42.1.2.	Non- intended to evaluate	N/A
42.1.2	A fully charged DUT shall be subjected to a water exposure test in accordance with the Standard for Degrees of Protection Provided by Enclosures (IP Code), IEC 60529 or CAN/CSA-C22.2 No. 60529, Tests for Protection Against Water Indicated by the Second Characteristic Numeral 4 (IPX4) unless the personal e-mobility device is provided with a higher IP Code rating, in which case the DUT shall be tested in accordance with its rating.		N/A
42.1.3	If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle. The test shall be followed by an observation period per 20.7 except that the observation period will be for a minimum of 48 hours.		N/A
42.1.4	At the conclusion of the observation period, the samples with hazardous voltage circuits shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30, (without humidity conditioning).		N/A
42.2	Partial immersion		N/A
42.2.1	The DUT is subjected to a partial immersion test representative of a personal e-mobility device exposure to puddles during operation as noted in 42.2.2.		N/A
42.2.2	The DUT is subjected to immersion in salt water (5% by weight NaCl in H2O) at a height sufficient to reach the personal e-mobility device foot support surface. The personal e-mobility device is partially immersed for 5 minutes.		N/A
42.2.3	If the DUT is operational after the test, it shall be subjected to a minimum of one charge/discharge cycle at the manufacturer's maximum specified values per Section 22, Post Test Cycle. If the DUT is non-operational, it shall be connected to a charger and determined that no hazard		N/A

	exists. The test shall be followed by an observation period per 20.7.		
42.2.4	At the conclusion of the observation period, the samples with hazardous voltage circuits shall be subjected to a Dielectric Voltage Withstand Test, Section 29, or Isolation Resistance Test, Section 30, (without humidity conditioning).		N/A
43	Thermal Cycling Test		P
43.1	This test determines the personal e-mobility device's ability to withstand exposure to rapidly changing environments such as when the personal e-mobility device is entering or exiting a heated garage after being in a cold environment, or during transport etc. without evidence of damage that could lead to a hazardous event.		P
43.2	A fully charged DUT shall be subjected to the thermal cycling in accordance with 43.3.		P
43.3	For the test, the DUT shall be placed in a chamber with ambient air cycling at the temperature extremes of either 60 ±2°C (140 ±3.6°F) or -20 ±2°C (-4 ±3.6°F). The transition period between exposure temperatures is to be 15 min or less. This swing of temperature variations may be performed either through the use of a fast-response chamber, or by moving the DUT between two chambers at the two test temperatures. The DUT shall remain at each temperature extreme for as long as required for the DUT to reach a uniform temperature (±5°C) of the chamber temperature but no less than 6 h. A total of five cycles (at the high and low temperature extremes) are to be performed.		P
44	Label Permanence Test		P
44.1	The purpose of this test is to evaluate the permanence of an adhesive label that has not been subjected to a previous evaluation program.		P
44.2	An adhesive label secured to a surface representative of the end use application and is subjected to the following conditioning: a) The label sample is rubbed by hand for 15 s with a piece of cloth soaked with water; and b) The sample is again rubbed for 15 s with a piece of cloth soaked with petroleum spirit.		P
44.3	The petroleum spirit to be used for the test is an aliphatic solvent hexane having: a) A maximum aromatics content of 0.1%		P

	by volume; b) A kauributenol value of 29; c) An initial boiling point of approximately 65°C (149°F); d) A dry point of approximately 69°C (156.2°F); and e) A mass per unit volume of approximately 0.7 kg/l.		

MARKINGS			
45	**General**		P
45.1	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		P
45.2	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.		P
45.3	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.		P
45.4	Personal e-mobility devices shall be marked with charging instructions. An example of such markings would be the following or equivalent "Use Only (__) Charger".		P
45.5	All external terminals and connections shall be provided with identification and if applicable, polarity markings.		P
45.6	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.		P
45.7	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		P

	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.		
45.8	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).		P
45.9	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).		P
45.10	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 42.1.		P
45.11	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 46.4.		P

Appendix 1: Critical components information					
Component Name	**Manufacturer/ trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity**
Plastic Enclosure	CHI MEI CORPORATION	PC-122(+)	Min thickness 1.7mm, V-2, HWI=2, HAI=0, 105ºC, screw for fixing	UL746 UL94	UL
PCB	Interchangeable	Interchangeable	V-1 or better,130°C, ,min 0.8mm,	UL769 UL94	UL
Battery	Anhui Chaoli Electronic Technology Co., Ltd.	48V15.6Ah	48V,15.6Ah	UL2271	Tested with appliances
Adapter	Tianchang Junnuo Technology Co,,Ltd.	JN-48	Input:100-240VAC,50/60Hz, 1.6A Output :54.6V, 2A	UL2272	Tested with appliances
Motor	Changzhou Guanma Electromechanical Co., LTD	GM-115fhl 450	24V/350W	--	--
Remark:					

24	**Overcharge Test**		P
Recommended max. discharging rate (A):2.0		Hazard voltage circuit: ~~Yes~~ / No	
Recommended max. charging rate (A):2.0		If The DUT is operational after the test: Yes / ~~No~~	
	Max. temperature of cell/module	Cell voltage	Appearance
Overcharge (non-faulted)	52.8℃	4.2	NF
Overcharge (fault: SC)	53.6℃	4.2	NF
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard			
Equipment Used:			

25	**Short Circuit Test**	P
Hazard voltage circuit: ~~Yes~~ / No		
If The DUT is operational after the test: Yes / ~~No~~		
	Max. temperature of cell/module	Appearance
Short + & -	62.4℃	NF
(fault: OC)	59.2℃	NF
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

26	**Overdischarge Test**	P
Recommended max. discharging rate (A):2.0	Hazard voltage circuit: ~~Yes~~ / No	
Cell voltage (V): 4.2	If The DUT is operational after the test: Yes / ~~No~~	
	Max. temperature of cell/module	Appearance
Overcharge (non-faulted)	48.7℃	NF
Overcharge (fault:SC)	45.1℃	NF
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

27	**Temperature Test**	P
Recommended max. discharging rate (A): 2.0A	Hazard voltage circuit: ~~Yes~~ / No	
Recommended max. charging rate (A): 2.0A	Upper charging temperature specification Ta : 45	

	Charging Under Ta	Discharging Under Ta
Max. temperature of cell/module	59.2	59.6
Max. temperature of accessible surfaces	58.8	56.3
Max. temperature of critical components	59.6	57.1
Enclosure	56.1	53.3

Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard

Equipment Used:

28	**Imbalanced Charging Test**	P
Recommended max. discharging rate (A): 2.0A	Hazard voltage circuit: ~~Yes~~ / No	
Recommended max. charging rate (A): 2.0A	If The DUT is operational after the test: Yes / ~~No~~	

	Cell 1 voltage	Cell 2 voltage	Appearance
Imbalanced charging (non-faulted)	3.7	3.7	NF
Imbalanced charging (fault: OC)	3.7	3.7	NF

Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard

Equipment Used:

29	**Dielectric Voltage Withstand Test**	P
Hazard voltage circuit: ~~Yes~~ / No		

Location	Voltage	Break down or not
Hazards voltage circuit to enclosure/accessible part	1000+2U	☐ Yes/ ☒ No
Hazards voltage charging circuit to enclosure/accessible part	1000+2U	☐ Yes/ ☒ No

Equipment Used:

30	**Isolation Resistance Test**	P
Hazard voltage circuit: ~~Yes~~ / No		
Location	Voltage	Measured insulation resistance
positive terminals and accessible parts	500 Vdc	100M Ω.
Equipment Used:		

33	**Vibration Test**	P
Hazard voltage circuit: ~~Yes~~ / No		
If The DUT is operational after the test: Yes / ~~No~~		
Appearance		
NF		
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

34	**Shock Test**	P
Hazard voltage circuit: ~~Yes~~ / No		
If The DUT is operational after the test: Yes / ~~No~~		
Temperatures on the center cell	Appearance	
35℃	No change	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

35	**Crush Test**	P
Hazard voltage circuit: ~~Yes~~ / No		
Appearance		
No change		
Note: NF= no fire, NE= no explosion, NS= no electric shock hazard		
Equipment Used:		

36	Drop Test	P
Hazard voltage circuit: ~~Yes~~ / No		
If The DUT is operational after the test: Yes / ~~No~~		
hazardous voltage parts accessibility	Appearance	
No change	No change	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

38	Handle Loading Test	P
Force applied	Appearance	
75-mm length	No change	
Equipment Used:		

39	Motor Overload Test	P
Hazard voltage circuit: ~~Yes~~ / No		
Temperatures on windings	Appearance	
77.0℃	No change	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

40	Motor Locked Rotor	P
Hazard voltage circuit: ~~Yes~~ / No		
Temperatures on windings	Appearance	
86.1℃	No change	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

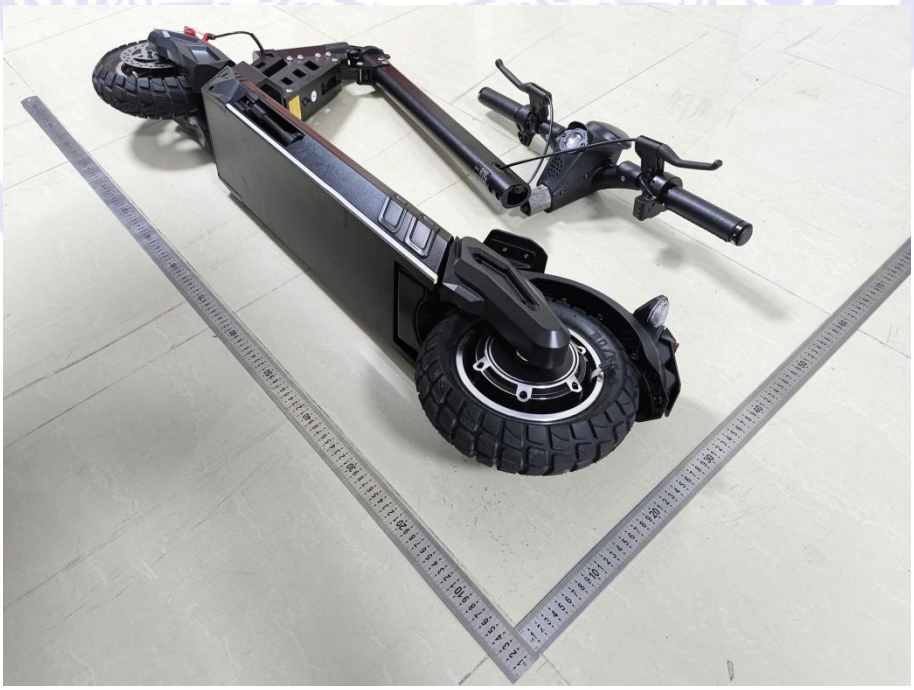
43	**Thermal Cycling Test**	P
Hazard voltage circuit: ~~Yes~~ / No		
If The DUT is operational after the test: Yes / ~~No~~		
Appearance:No hazards		
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard		
Equipment Used:		

44	**Label Permanence Test**		P
Location of Marking	No legible?	Easily removed?	Show curling?
Label	~~Yes /~~ No	~~Yes /~~ No	~~Yes /~~ No
Equipment Used:			

Attachment I Photos of Product

EUT Photo 1

EUT Photo 2



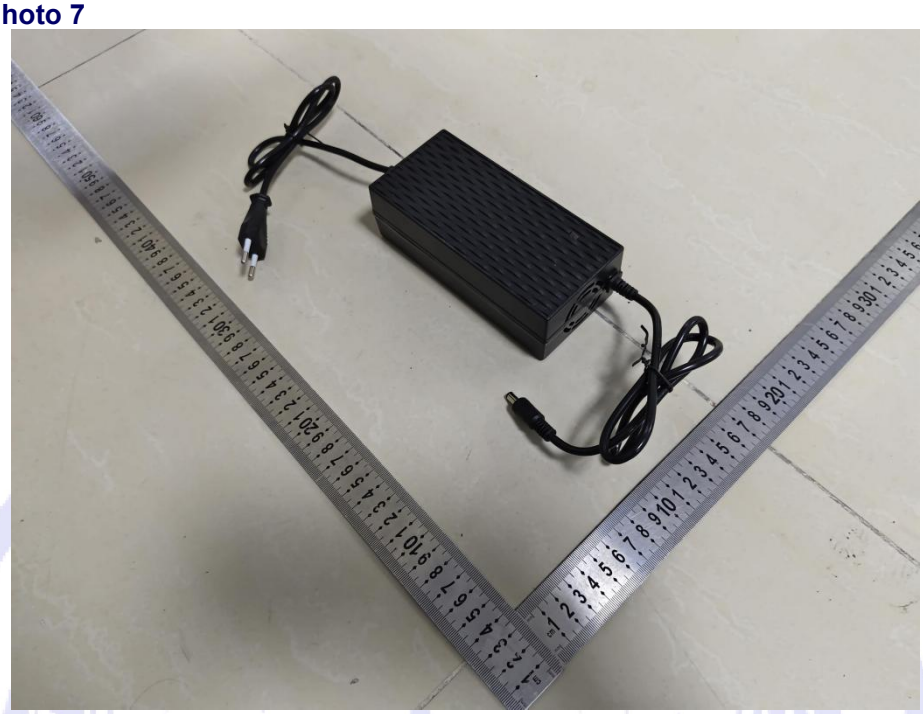
EUT Photo 3

EUT Photo 4

EUT Photo 5

EUT Photo 6

EUT Photo 7



EUT Photo 8

------ End of Report ------