



TEST REPORT
UL 2849
STANDARD FOR SAFETY
Electrical Systems for eBikes

Report Number	: LH-230901242807	
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Testing Laboratory	: Shenzhen LH Testing Technology Co., Ltd.	
Address	: 106 and 107, building B15, Yintian Industrial Zone, Yantian community, Xixiang street, Bao'an District, Shenzhen	
Applicant's name	: Dongguan Xingji Outdoor Sports Products Co., Ltd.	
Address	: Room101, No.27, Lufeng East Street, Changan Town, Dongguan City, Guangdong Province	
Test specification:		
Standard	: UL Standard for Safety for Electrical Systems for eBikes, UL 2849 First Edition, Dated January 2,2020	
Test procedure	: UL test report	
Non-standard test method	: N/A	
Test Report Form No	: UL 2849	
Test Report Form(s) Originator	: LH	
Master TRF	: 2022-08	
Remark : 1.The test conclusion to identify only in view of the actual test terms, do not represent without detection project or function meets the requirements. 2.The test results only for samples. 3.Test items are specified by the customer.		
Test Item description	: Electric Bicycle	
Trade Mark	: N/A	
Manufacturer	: Dongguan Xingji Outdoor Sports Products Co., Ltd. Room101, No.27, Lufeng East Street, Changan Town, Dongguan City, Guangdong Province	
Model/Type reference	: X21	
Ratings	: Input: 48V 2A	

Product information	
Product name.....:	Electric Bicycle
Brand name.....:	N/A
Model/Type reference.....:	See page 1
Ratings.....:	See marking plate
TESTING:	
Date of receipt of test item.....:	Sep. 13, 2023
Date (s) of performance of tests.....:	Sep. 13, 2023 to Sep. 20, 2023
<p>General product information:</p> <p>The product covered in this report is a Electric Bicycle, which is supplied from battery, these ratings see the label of output rating for details.</p> <p>Relevant Technical consideration :</p> <p>-Maximum ambient temperature: 25° C</p>	
<p>Copy of marking plate (Representative):</p> <div style="border: 1px solid black; padding: 20px; margin: 20px auto; width: fit-content;"> <p style="text-align: center;">Electric Bicycle</p> <p>Model: X21 Input: 48V  2A</p> <p style="text-align: center;"></p> <p>Dongguan Xingji Outdoor Sports Products Co., Ltd.</p> <p style="text-align: right;">Made in China</p> </div>	
<p>Notes:</p> <ul style="list-style-type: none"> - Date code “YYMDDA” will change as actual production date. - Due to similarity of rating labels, only above label is listed. <p>Model Differences – N/A</p>	

Test Requested :

UL Standard for Safety for Electrical Systems for eBikes, UL 2849 Issued: 2020/01/02 Ed. 1		
Clause	Description Requirement	Verdict
27	Input Test	P
28	Temperature Test	P
29	Isolation Resistance Test	P
30	Dielectric Strength Test	P
32.2	Overcharging test	P
32.4	Forced ventilation/blocked ventilation	N/A
32.5	Locked rotor motor test	P
32.6	Running overload test	P
32.7	Short circuit test	N/A
32.8	Imbalanced charging test	N/A
32.9	Shock test	N/A
32.10	Thermal cycling	N/A
33	Impact Test	P
35	Flexing Test	N/A
36	Ingress Protection Tests	P
37	Permanence of Marking	P
38	Vibration Test	P
39.2	Strain relief - pull test	N/A
39.3	Strain relief - push back test	N/A
40	Startup Assistance Mode Test	N/A
41.2	Reverse Pedaling Test	P
41.3	Pedal Cessation Test for EPACs	P
41.4	Cutoff When Braking Test	P
41.5	Cutoff at Maximum Speed Test	P

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)

Appendix 1: Critical components information					
Component Name	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity
Frame	Various	Various	Min thickness 1.7mm, V-2, HWI=2, HAI=0, 105°C, screw for fixing	UL746 UL94	UR
Controller	Various	Various	DC36V	--	UR
MOTOR	Various	Various	48V	--	--
Battery	Various	Various	Various	--	--
Remark:					



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Clause	Requirement + Test	Result - Remark	Verdict

INTRODUCTION

1	Scope		P
1.1	1.1 This Standard covers the electrical system of eBikes powered by a lithium-based, rechargeable battery. EBikes include both Electrically Power Assisted Cycle (EPAC - pedal assist) and non-pedal assist eBikes.		P
1.2	Electrical systems as referenced in 1.1, may include onboard components and off board components of eBikes. As a minimum, the electrical system consists of the drive unit, battery, battery management system (BMS), interconnecting wiring, and power inlet. Any additional components or systems required to demonstrate compliance are included based on the overall system application and risk.		P
1.3	Off board components include dedicated chargers for charging batteries that are removed from the eBike during charging or dedicated chargers for charging batteries that are in place on the eBike during charging.		P

ELECTRICAL TESTS

27	Input Test		P
27.1	The input current to a product is to be measured with the unit operating while charging a fully discharged battery. The current input of the product shall not be more than 110 percent of the rated current value for the eBike as assigned by the manufacturer and if an external charger is used, the measured input current shall not exceed the rated output current of the external charger.		P
28	Temperature Test		P
28.1	The Temperature test shall be conducted to determine whether or not the temperature sensitive safety critical components and temperature sensitive materials in the eBike components are being maintained within their temperature ratings and that temperatures on accessible surfaces, which may be contacted by the user, are within acceptable limits. Additionally, 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 eBike.		P
28.2	The test is to be performed using two methods. The battery charging circuit and battery are tested		P



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Clause	Requirement + Test	Result - Remark	Verdict
	in accordance with 28.3 - 28.7, and the eBike system is tested in accordance with 28.8 - 28.9.		
28.3	<p>First, a fully discharged battery pack is to be conditioned within a chamber set to the upper limit charging temperature specifications of the eBike manufacturer. After thermal stabilization in the chamber,</p> <p>the battery pack is to be connected to a charging circuit input representative of anticipated maximum charging parameters provided by the specified charger. The battery pack shall then be subjected to</p> <p>maximum normal charging while monitoring voltages and currents on cells until it reaches the manufacturer's specified fully charged condition. Temperatures shall be monitored on temperature sensitive components including cells, enclosure, and all parts within the charging circuit that are temperature sensitive, including any user accessible surfaces.</p>		P
28.4	<p>While still in the conditioning chamber, and after allowing temperatures to stabilize, the fully charged battery pack shall then be discharged in accordance with the manufacturer's specifications representative</p> <p>of maximum weight and operating conditions for loading down to the manufacturer's specified end of discharge condition while monitoring voltage and current on cells until the battery pack reaches its specified end of discharge voltage (EODV). Temperatures shall be monitored on temperature sensitive</p> <p>safety critical components including cells, enclosure, and all parts within the charging circuit that are temperature sensitive, including any user accessible surfaces.</p>		P
28.5	<p>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</p> <p>followed by an observation period per 20.7.</p>		P
29	Isolation Resistance Test		P
29.1	<p>This test is intended to determine that insulation of the equipment provides adequate isolation of hazardous voltage circuits from accessible conductive parts and that the insulation is non-hygroscopic.</p> <p>The measured insulation resistance between the positive terminals and accessible parts of the equipment shall be at least 50,000 Ω.</p>		P



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29.2	Equipment with accessible parts shall be subjected to an insulation resistance test between the positive terminal and accessible dead metal parts. If the accessible parts 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 30.4 and Figure 30.1.		P
29.3	The insulation resistance shall be measured after a 60-s application with a high resistance voltmeter using a 500 V dc potential applied for at least 1 minute to the locations under test.		P
29.4	The test shall be repeated on a representative unit subjected to humidity conditioning in accordance with Section 31. Measurements shall be made with the unit still in the chamber.		P
30	Dielectric Strength Test		P
30.1	This test is an evaluation of the electrical spacings and insulation at hazardous voltage circuits within the equipment. There shall be no evidence of a dielectric breakdown (breakdown of insulation resulting in a short through insulation/arc over electrical spacings) as evidenced by an appropriate signal from the dielectric withstand test equipment as a result of the applied test voltage. Corona discharge or a single momentary discharge is not regarded as a dielectric breakdown (i.e., insulation breakdown).		P
30.2	Circuits at 60 Vdc or higher shall be subjected to a dielectric withstand voltage consisting of a dc potential of twice the rated dc voltage or twice the rated ac voltage times 1.414. Semiconductors or similar electronic components liable to be damaged by application of the test voltage may be bypassed or disconnected.		P
30.3	The test voltage is to be applied between the hazardous voltage circuits and non-current carrying conductive parts that may be accessible.		P
30.4	If the accessible parts of the equipment 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. The metal foil shall be wrapped tightly around and in intimate contact with the accessible part. The foil is to be drawn tightly across any opening in the enclosure		P



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	or other accessible parts to form a flat plane across such opening. See Figure 30.1.		
31	Humidity Conditioning		P
31.1	A product shall comply with the requirements for the Dielectric Strength Test, Section 30, and the Isolation Resistance Test, Section 29, following exposure to air having a relative humidity of 88 ± 2 percent at a temperature of $32 \pm 2^{\circ}$ C ($90 \pm 4^{\circ}$ F).		P
31.2	To determine whether a unit complies with the requirement in 31.1, a representative unit is to be heated to a temperature just above 34° C (93° F) to reduce the risk of condensation of moisture during conditioning. The heated unit is to be placed in the humidity chamber and is to remain for 48 hours under the conditions specified in 31.1. Immediately following the conditioning, the unit is to be removed from the humidity chamber and tested as described in 31.1.		P
32	Abnormal Operations Tests		P
32,2	Overcharging test		P
32.2.1	This test is intended to evaluate the ability of the electrical system of the eBike to withstand an overcharge condition under a single fault in the charging control circuitry that could result in an overcharge condition. One representative system is to be tested for each fault condition applied. The same system can be used for more than one test if it remains functional after the fault is removed. For battery packs in accordance with 11.1(a) or 11.1(b), this test is not required.		P
32.2.2	A fully charged battery is to be discharged at a constant discharge rate of 0.2 times the manufacturer's rated capacity of the battery, or a higher discharge rate permitted by the manufacturer to the manufacturer's specified end-of-discharge voltage. The first representative system is then subjected to a constant current charging at the manufacturer's specified charging rate (i.e. based upon the maximum intended charger output current rate) 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. For information purposes, temperatures are to be monitored on the cell/module where temperatures may be highest. The output control		P



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Clause	Requirement + Test	Result - Remark	Verdict
	circuitry of external chargers with standardized output connectors that may result in the use of unspecified chargers shall not be considered as a reliable control to prevent an overcharging condition.		
32.2.3	The test is to be continued until the voltage has reached 110 percent of the maximum specified voltage limit and/or monitored temperatures return to ambient or steady state conditions and an additional 2 hours has elapsed, or explosion/fire occurs. If the system 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 a 1-hour observation time prior to concluding the test and temperatures are to be monitored.		P
32.2.4	At the conclusion of the observation period, systems that contain hazardous operating voltages shall be subjected to a Dielectric Voltage Withstand Test, Section 30, or an Isolation Resistance Test, Section 29, (without humidity conditioning).		P
32.2.5	If a protective device in the circuit operates, the test is repeated at 90 percent of the trip point of the protection device or at some percentage of the trip point that allows charging for at least 10 minutes. Temperatures shall be measured on the cell/module where temperatures may be highest for monitoring purposes.		P
32.2.6	As a result of the overcharge test, there shall be no indication of any noncompliant results as outlined in 32.1.		P
32.3	Component fault tests		P
32.3.1	A component, such as a capacitor, diode, solid state device, or similar device, connected in the input and output power circuits are to be short- or open-circuited, any two terminals one at a time, during any condition of operation including start-up. This test is not required: a) Where circuit analysis indicates that no other component or portion of the circuit is overloaded; b) or electromagnetic radio frequency interference capacitors subjected to the Dielectric Strength Test across their terminals in accordance with Section 30; and c) For resistors, transformers, inductors, and optical isolators.		P



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32.4	Forced ventilation/blocked ventilation		N/A
32.4.1	A unit having forced ventilation is to be operated with the rotor of a blower motor or fan locked. For a unit having more than one blower motor or fan, the test is to be conducted with the rotor of each blower motor or fan locked, one at a time, unless agreeable to all for which all blower motors or fans shall be locked at the same time.	No such device	N/A
32.4.2	A unit having filters over ventilation openings is to be operated with the openings blocked to represent clogged filters. The test is to be conducted initially with the ventilation openings blocked 50 percent, then to be repeated under fully blocked condition.		N/A
32.5	Locked rotor motor test		P
32.5.1	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 and motor protector combination evaluation, in accordance with UL 1004-3 and CSA C22.2 No. 77, or UL 1004-7 and CSA C22.2 No. 77, or if relying on impedance protection in accordance with UL 1004-2 and CSA C22.2 No. 77, as applicable.		P
32.5.2	The motor is operated at the voltage used in the eBike application and with its rotor locked for 7 h or until steady conditions are established. The motor is to be tested while on the eBike and temperatures on windings are to be monitored. As an alternative, the motor can be tested outside of the eBike.		P
32.5.3	If the design or size of the motor prevents the measuring of temperatures on the windings, the test may be conducted with the motor removed from the eBike and instead of monitoring temperatures, the motor is to be supported on a surface covered with a single layer of tissue paper with the motor covered with a single layer of cheesecloth.		P
32.5.4	If the motor contains a hazardous voltage circuit, the motor shall be subjected to a Dielectric Voltage Withstand Test, Section 30, or Isolation Resistance Test, Section 29, (without humidity conditioning).		P
32.5.5	If monitoring temperatures on windings during the locked rotor test, the temperatures on the windings shall not exceed the values noted in Table 32.1. If not monitoring temperatures on		P



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	windings during the test, there shall be no sign of ignition of the tissue or cheesecloth at the conclusion of the test.		
32.6	Running overload test		P
32.6.1	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 in accordance with UL 1004-3 and CSA C22.2 No. 77, or UL 1004-7 and CSA C22.2 No. 77, as applicable to the method of thermal protection.		P
32.6.2	The motor is to be tested while in the eBike and temperatures on windings are to be monitored. As an alternative, the motor can be tested outside the eBike.		P
32.6.3	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
32.6.4	The motor winding temperatures are determined during each steady period and the maximum temperature recorded shall not exceed the value in Table 32.2.		P
32.7	Short circuit test		N/A
32.7.1	This test evaluates the ability of the battery pack to withstand a short circuit condition under a single fault in the charging control circuitry. For battery packs in accordance with 11.1(a) or 11.1(b), this test is not required.	Conform to UL2271	N/A
32.7.2	A fully charged representative battery pack is to be short-circuited by connecting the positive and negative terminals of the battery pack with a circuit load having a total resistance of less than or equal to 20 mohms.		N/A
32.7.3	Representative battery packs are to be subjected to a single fault across any protective device in the charging control circuit. Protective devices that have been determined reliable may remain in the circuit.		N/A
32.7.4	The representative battery pack shall be		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
	discharged until the battery pack has returned to ambient temperature or fire or explosion occurs. Temperatures shall be measured on the cell/module where temperatures may be highest for monitoring purposes.		
32.7.5	If the electrical system of the eBike 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 a 1-hour observation time prior to concluding the test and temperatures are to be monitored.		N/A
32.7.6	If a protective device in the circuit operates, the test is repeated at 90 percent of the trip point of the protection device or at some percentage of the trip point that allows discharging for at least 10 min.		N/A
32.7.7	At the conclusion of the test and after cooling to near ambient, representative battery packs that contain a hazardous operating voltage shall be subjected to a Dielectric Voltage Withstand Test, Section 30, or an Isolation Resistance Test, Section 29, (without humidity conditioning).		N/A
32.7.8	As a result of the Short Circuit Test, there shall be no indication of any noncompliant results as outlined in 32.1.		N/A
32.8	Imbalanced charging test		N/A
	32.8.1 This test is to determine whether or not the battery pack, with series connected cells, can maintain the cells within their specified operating parameters if it becomes imbalanced. For battery packs in compliance with 11.1(a) or 11.1(b), this test is not required.	Conform to UL2271	N/A
32.8.2	A fully charged battery pack of an eBike 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 percent of its specified state of charge (SOC) to create an imbalanced condition prior to charging.		N/A
32.9	Shock test		N/A
32.9.1	This test is intended to determine whether or not the battery pack can withstand a mechanical shock that may occur when in use. For battery packs in compliance with 11.1(a) or 11.1(b), this test is not required.	Conform to UL2271	N/A
32.9.2	The fully charged battery pack is to be secured to the testing machine by means of a rigid mount, which supports all mounting surfaces of the		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
	sample. Temperatures on the center cell are monitored for information purposes.		
32.9.3	The battery pack is to be subjected to mechanical shock testing with parameters as shown in Table 32.3. The shocks are to be applied in all 6 spatial directions.		N/A
32.9.4	If the electrical system of the device 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 a 1-hour observation time prior to concluding the test and temperatures are to be monitored.		N/A
32.9.5	At the conclusion of the observation period, devices that contain hazardous operating voltages shall be subjected to a Dielectric Voltage Withstand Test, Section 30, or an Isolation Resistance Test, Section 29 (without humidity conditioning).		N/A
32.9.6	As a result of the test, there shall be no indication of any noncompliant results as outlined in 32.1.		N/A
32.10	Thermal cycling		N/A
32.10.1	This test determines the ability of the battery pack of the eBike to withstand exposure to rapidly changing environments such as when the eBike is entering or exiting a heated storage facility after being in a cold environment, changing temperatures during transport or storage outdoors, and the like, without evidence of damage that could lead to a hazardous event.		N/A
32.10.2	A fully charged battery shall be subjected to the thermal cycling in accordance with 32.10.3. For battery packs in compliance with 11.1(a) or 11.1(b), this test is not required.		N/A
33	Impact Test		P
33.1	unit acting as an enclosure shall be subjected to this test. The enclosure is to be subjected to an impact of 6.8 J (5 foot-pounds) on any surface that is exposed to a blow during normal use. This impact is to be produced by dropping a steel sphere, 50.8 mm (2 inches) in diameter and weighing 535 g (1.18 pounds), from a height of 1.29 m (51 inches) to produce the 6.8 J (5 foot-pound) impact. For surfaces other than the top, the steel sphere is to be suspended by a cord and swung as a pendulum, dropping through a vertical distance of 1.29 m (51 inches) to strike the surface.		P



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33.2	A unit is to be subjected to the impact test described in 33.1 with or without any attachment specified by the manufacturer so as to result in the most severe test.		P
33.3	When the part under test is made of polymeric material, the impact test is to be first conducted on a representative unit or units in the as-received condition. The test is then to be repeated on a different unit or units that have been cooled to room temperature after being conditioned for 7 hours in an air oven operating at 10° C (18° F) higher than the maximum operating temperature of the material, and not less than 70° C (158° F). While being conditioned, a part is to be supported in the same manner in which it is supported on the unit.		P
33.4	Upon being removed from the oven mentioned in 33.3 and before being subjected to the impact test, no units shall show signs of cracking or other deleterious effects from the oven conditioning, and no unit shall be distorted so as to result in a risk of injury to persons.		P
33.5	After the impact test, any openings resulting from the test shall be evaluated for access to hazardous live parts using the articulate probe shown in Figure 18.1.		P
35	Flexing Test		N/A
35.1	After wiring has been subjected to flexing as described in 35.2, the unit shall be subjected to the Dielectric Voltage-Withstand Test in Section 30 and the wiring is to be examined for damage to determine where any conductors are broken or where individual strands have penetrated the insulation.		N/A
35.2	Wiring that is subjected to movement at times other than installation and servicing is to be tested by cycling the moving part through the maximum travel intended for the construction. The duration of the test is to be 500 cycles.		N/A
36	Ingress Protection Tests		P
36.1	This test is intended to evaluate the ability of the eBike to withstand potential water exposure in its intended use and is conducted in accordance with the test method outlined in 36.2.	IPX4	P
36.2	The enclosure shall be subjected to a water exposure test in accordance with the Standard for Degrees of Protection Provided by Enclosures (IP Code), IEC 60529, Tests for Protection Against Water Indicated by the Second Characteristic Numeral 4		P



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	(IPX4), unless the equipment is provided with a higher IP Code rating by the manufacturer, in which case the equipment shall be tested in accordance with its rating. During this test, the enclosure is to be mounted in the manner intended when installed on the eBike. If multiple mounting orientations are allowed, then each one is to be tested individually.		
36.3	If the equipment 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 in accordance with 26.8.		P
36.4	At the conclusion of the observation period, the units shall be subjected to a Dielectric Strength Test, Section 30, or an Isolation Resistance Test, Section 29, (without humidity conditioning).		P
36.5	As a result of the test, there shall be no indication of fire, explosion, rupture, electrolyte leakage, or shock hazard.		P
37	Permanence of Marking		P
37.1	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
37.2	An adhesive label secured to a surface representative of the end use application and is subjected to the following conditioning. The label is rubbed by hand for 15 s with a piece of cloth soaked with water. This is then repeated using petroleum spirit.		P
37.3	The petroleum spirit to be used for the test is an aliphatic solvent hexane having: a) A maximum aromatics content of 0.1 percent 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 (5.8 lb/gal).		P
37.4	After the conditioning outlined in 37.2, the unit is to be examined for signs of damage including curing and to determine if the marking is still legible. The unit is also examined to determine if it can be removed easily by hand from the adhered surface.		P



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37.5	As a result of the conditioning, the representative label shall remain legible, show no evidence of damage including curling and shall not be able to be easily removed by hand from the adhered surface.		P
38	Vibration Test		P
	An eBike system, or parts of the system, intended to be permanently mounted on an eBike shall be subjected to a vibration test. After the unit is subjected to the vibration test described in 38.1.2: a) The eBike system shall not emit flame or molten metal or become a risk of fire, electric shock, or injury to persons; b) There shall be no loosening of parts; and c) The components shall operate normally.		P
39	Strain Relief		N/A
39.2	Strain relief - pull test		N/A
39.2.1	The strain relief means provided for each interconnecting cable as specified in 39.1.1 shall withstand a direct pull of 156 N (35 pounds) applied to the cord for one minute without displacement. The strain relief does not comply when at the point of disconnection of the conductors, there is such movement as to indicate that stress on the connections results.		N/A
39.2.2	The weight is to be suspended from the cable and supported by the unit so that the strain relief means is stressed from any angle of the unit.		N/A
39.3	Strain relief - push back test		N/A
39.3.1	The interconnecting cable as specified in 39.1.1 shall be prevented from being pushed into the product through the cord entry hole where such displacement is likely to: a) Subject the cable to mechanical damage or to exposure to a temperature higher than that for which the cable is rated; b) Reduce spacings below the minimum intended values; or c) Damage internal connectors or components		N/A
39.3.2	The cable is to be held 25.4 mm (1 inch) from the point where the cable emerges from the unit and is then to be pushed back into the unit. The cable is to be pushed back into the unit in 25.4 mm (1 inch) increments until the cable buckles or the force to push the cable into the unit exceeds 26.7 N (6pounds force). The cable, within the unit, is to be manipulated to the worst case position during		N/A



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	the test to determine compliance with 39.3.1.		
40	Startup Assistance Mode Test		N/A
40.1	EBikes or EPACs provided with a startup assistance mode are to be tested. The startup assistance mode shall have a maximum speed of 6 kph (3.7 mph) and the assistance shall stop when the activation control is released.		N/A
40.2	The representative eBike or EPAC shall be provided with a fully charged battery for this test. The test can be performed on a test track or on a test bench that keeps the assisted wheel free of the ground during the test.		N/A
40.3	Motor current is to be monitored throughout the test. Prior to any start of pedaling (stand by condition), the motor current is measured and recorded. This is considered the no-load current point. During the test, the current to the motor will increase due to motor assist. The test is terminated when the motor returns to this no-load current point.		N/A
40.4	The unit is to be operated for 5 minutes at a speed equal to 80 percent of its marked maximum assistance speed and then the representative eBike or EPAC is stopped. The startup assistance mode is activated and run for 1 minute. At the end of the 1 minute, the maximum speed is recorded.		N/A
40.5	At the end of the 1 minute duration in 40.4, the activation control is released and the motor current is observed. When the motor current returns to the no-load current point, the test is ended.		N/A
41.2	Reverse Pedaling Test		P
41.2.1	The motor assistance shall not be activated when the pedals are operated in reverse. The motor current shall not increase above the no-load current point when tested in accordance with 41.2.2 - 41.2.4.		P
41.2.2	The sample shall be provided with a fully charged battery for this test. The test can be performed on a test track or on a test bench that keeps the assisted wheel free of the ground during the test.		P
41.2.3	Motor current is to be monitored throughout the test. Prior to any start of pedaling (stand by condition), the motor current is measured and recorded. This is considered the no-load current point. During the test, the current to the motor will increase due to motor assist. The test is terminated when the motor returns to this No-load current point.		P



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Clause	Requirement + Test	Result - Remark	Verdict
41.2.4	The pedals are operated in reverse and the motor current value is observed. The motor current value is recorded during this operation and shall not exceed the non-assist current value.		P
41.3	Pedal Cessation Test for EPACs		P
41.3.1	The motor assistance of an EPAC shall cutoff within 2 meters (6.6 feet) of travel distance when the user stops pedaling. The motor current shall decrease to or below the no-load current point within those 2 meters.		P
41.3.2	The sample shall be provided with a fully charged battery for this test. The test can be performed on a test track or on a test bench that keeps the assisted wheel free of the ground during the test.		P
41.3.3	Motor current is to be monitored throughout the test. Prior to any start of pedaling (stand by condition), the motor current is measured and recorded. This is considered the no-load current point. During the test, the current to the motor will increase due to motor assist. The test is terminated when the motor returns to this no-load current point.		P
41.3.4	The sample is operated at 90 percent of the marked maximum assistance speed and then pedaling is ceased. The distance traveled is measured from the time pedaling ceases to the time the motor current is at or below the no-load current point. No braking shall occur during this test.		P
41.3.5	With reference to 41.3.4, the distance traveled can be determined in the test bench by calculation using the number of rotations of a given wheel size.		P
41.4	Cutoff When Braking Test		P
41.4.1	The motor assistance shall cutoff when the brake device is actuated.		P
41.4.2	The sample shall be provided with a fully charged battery for this test. The test can be performed on a test track or on a test bench that keeps the assisted wheel free of the ground during the test.		P
41.4.3	Motor current is to be monitored throughout the test. Prior to any start of pedaling (stand by condition), the motor current is measured and recorded. This is considered the no-load current point. During the test, the current to the motor will increase due to motor assist. The test is terminated when the motor returns to this no-load current point.		P



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Clause	Requirement + Test	Result - Remark	Verdict
41.4.4	The sample is operated at any convenient speed for this test. While pedaling, the brake device is actuated and the motor current shall be interrupted and begin to decrease. This test is repeated for each brake device that is provided with cutoff functionality, one brake device for each test.		P
41.5	Cutoff at Maximum Speed Test		P
41.5.1	The motor assistance shall be cutoff on or before the sample obtains the marked maximum assistance speed when tested as indicated in 41.5.2 - 41.5.4.		P
41.5.2	The sample shall be provided with a fully charged battery for this test. The test can be performed on a test track or on a test bench that keeps the assisted wheel free of the ground during the test.		P
41.5.3	Motor current is to be monitored throughout the test. Prior to any start of pedaling (stand by condition), the motor current is measured and recorded. This is considered the no-load current point. During the test, the current to the motor will increase due to motor assist. The test is terminated when the motor returns to this no-load current point.		P
41.5.4	The sample is to be operated for 5 minutes at a speed equal to 80 percent of its marked maximum assistance speed. After this duration, the speed is increased to the maximum speed the motor will allow but not more than 125 percent of the marked maximum assistance speed. The motor current shall be reduced to the no-load current point when, or before, the maximum speed of the sample reaches the marked maximum assistance speed		P
MARKINGS			
43	Nameplate and Identification		P
43.1	Products shall 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.		P
43.2	Products shall be marked with the date of manufacture, which may be in the form of a code that does not repeat within 10 years.		P
43.3	Products that are provided with a battery pack that has its battery management system residing in components or circuits outside the battery pack		P



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Clause	Requirement + Test	Result - Remark	Verdict
	shall be marked with the charger that is specified for use. An example of such markings would be the following or equivalent "Use Only Charger (____)." The blank would be filled in with identifying information for the charger.		
43.4	All external terminals and connections intended to be made in the field, including the battery terminals if the battery pack is not keyed, shall be provided with identification and if applicable, polarity markings.		P
43.5	If a manufacturer produces or assembles eBike systems at more than one factory location, the equipment shall have a distinctive marking - which may be in code - to identify it as the product of a particular factory.		P
44	Cautionary Markings		P
44.1	The words, "CAUTION", "WARNING", OR "DANGER" in a cautionary marking shall be in letters not less than 3.2 mm (1/8 inch) high. The remaining letters in a cautionary marking shall not be less than 1.6 mm (1/16 inch) high. The words, "WARNING" or "DANGER" are alternatives for the word, "CAUTION" .		P
44.2	A cautionary marking shall be located on a part that is not removable; or if removable, on a part that impairs the operation of the unit when removed. The marking shall also be visible and legible to the operator during normal operation of the unit.		P
44.3	There shall be a replacement marking adjacent to a fuse or fuseholder if the fuse is used to reduce the risk of fire and electric shock and the fuse is user replaceable. The marking shall be located where it will be readily visible during replacement of the fuse, and shall consist of the word, "WARNING" and the following or equivalent: "Risk of Fire and Electric Shock - Replace Only With Same Type and Ratings of Fuse."		P



27	TABLE: Input test						P
U (V)	I (A)	I rated (A)	P (W)	P rated (W)	Fuse No	I fuse (A)	Condition/status
DC48V	1.68	2.0	--	--	--	--	Normal operation
Supplementary information:							

28	Temperature Test		P
Recommended max. discharging rate (A): 2A		Hazard voltage circuit: Yes / No	
Recommended max. charging rate (A): 2A		Upper charging temperature specification Ta : 45	
	Charging Under Ta	Discharging Under Ta	
Max. temperature of cell/module	54.6	62.7	
Max. temperature of accessible surfaces	49.0	53.6	
Max. temperature of critical components	41.4	45.4	
Appearance	43.0	46.4	
Charging/ discharging current	41.0	49.5	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard			
Equipment Used:			

29	Isolation Resistance Test		P
Hazard voltage circuit: Yes/ No			
Location	Voltage	Measured insulation resistance	
positive terminals and accessible parts	500 Vdc	56,000 Ω.	
Equipment Used:			

30	Dielectric Voltage Withstand Test		P
Hazard voltage circuit: Yes / No			
Location	Voltage	Break down or not	
Hazards voltage circuit to enclosure/accessible part	2U	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	
Hazards voltage charging circuit to enclosure/accessible part	2U	<input type="checkbox"/> Yes/ <input checked="" type="checkbox"/> No	
Equipment Used:			



32.2	Overdischarge Test		P
Recommended max. discharging rate (A):5		Hazard voltage circuit: Yes / No	
Cell voltage (V): 48		If The DUT is operational after the test: Yes / No	
	Max. temperature of cell/module	Appearance	
Overcharge (non-faulted)	50°C	NF	
Overcharge (fault:SC)	54°C	NF	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard			
Equipment Used:			

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

32.6	Running overload test		P
Hazard voltage circuit: Yes / No			
Temperatures on windings		Appearance	
92		No change	
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard			
Equipment Used:			

33	Impact 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:			

36.1	IPX4 Code rating		P
Hazard voltage circuit: Yes / No			



If The DUT is operational after the test: Yes / No
Appearance: NS
Note: NF= no fire, NE= no explosion, NR= no rupture, NL= no electrolyte leakage, NS= no electric shock hazard
Equipment Used:

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

38	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:				



Photo-documentation

EUT PHOTO 1



EUT PHOTO 2





EUT PHOTO 3



EUT PHOTO 4



----- END OF REPORT-----